PUBLIC WORKS

An Engineering and Construction Journal

City County State

VOL. 63 JUNE, 1932 NO. 6

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Brain Teasers:

From Chicago comes this one furnished by George Darby of the Dorr Co. "Having a cubical box with inside dimensions of 1 foot, a sphere just touching the six sides is placed in the box. How large a sphere can now be placed in any corner of the box so it will just touch the larger sphere and three sides of the box?"

And here's another picked from a pile on the desk: A number contains six integers. If multiplied by either 2, 3, 4, 5 or 6, the product consists of the same integers arranged in the same sequence, but beginning with a different one each time. What is the number?

Those Students:

That problem by Mr. Steinman *was* a tough one. The least correct answer is 595 graduates and 1246 enrolled, so far as we know. R. S. Chubb, Borough engineer of Hamburg, Pa., came through with a very ingenious solution, but his answer showed 3,095 graduates, and 6,430 enrollment. Prof. Folwell, using S= seniors; j=juniors; s=sophomores; and f=freshmen, got the following equations:

$$5S=6x+5$$
$$5j=6S+10$$
$$5s=6j+15$$
$$5f=6s+20$$

X being the number of graduates, and by substituting and solving got a value of X=595. D. C. Elder reported the correct answer, but not the method of working.

Benjamin Eisner using "n" as a parameter having any assigned value satisfying the conditions at any stage of the problem, gets the following:

Graduates is a number divisible by 5	$=5n$
Seniors flunked	$=n$
Seniors quit	$=1$
Total seniors	$=1+6n$
Total seniors divisible by 5	$=25+30n$
Juniors flunked	$=5+6n$
Juniors quit	$=2$
Total juniors	$=32+36n$
Total juniors divisible by 5	$=140+180n$
Sophomores flunked	$=28+36n$
Sophomores quit	$=3$
Total sophomores	$=171+216n$
Total sophomores divisible by 5	$=1035+1080$;
Freshmen flunked	$=207+216n$
Freshmen quit	$=4$
Total enrollment	$=1246+1296n$
Least enrollment (n=o)	$=1246$
Least number to graduate	$=595$

The answer to the rock cube problem was 0.01 inch.

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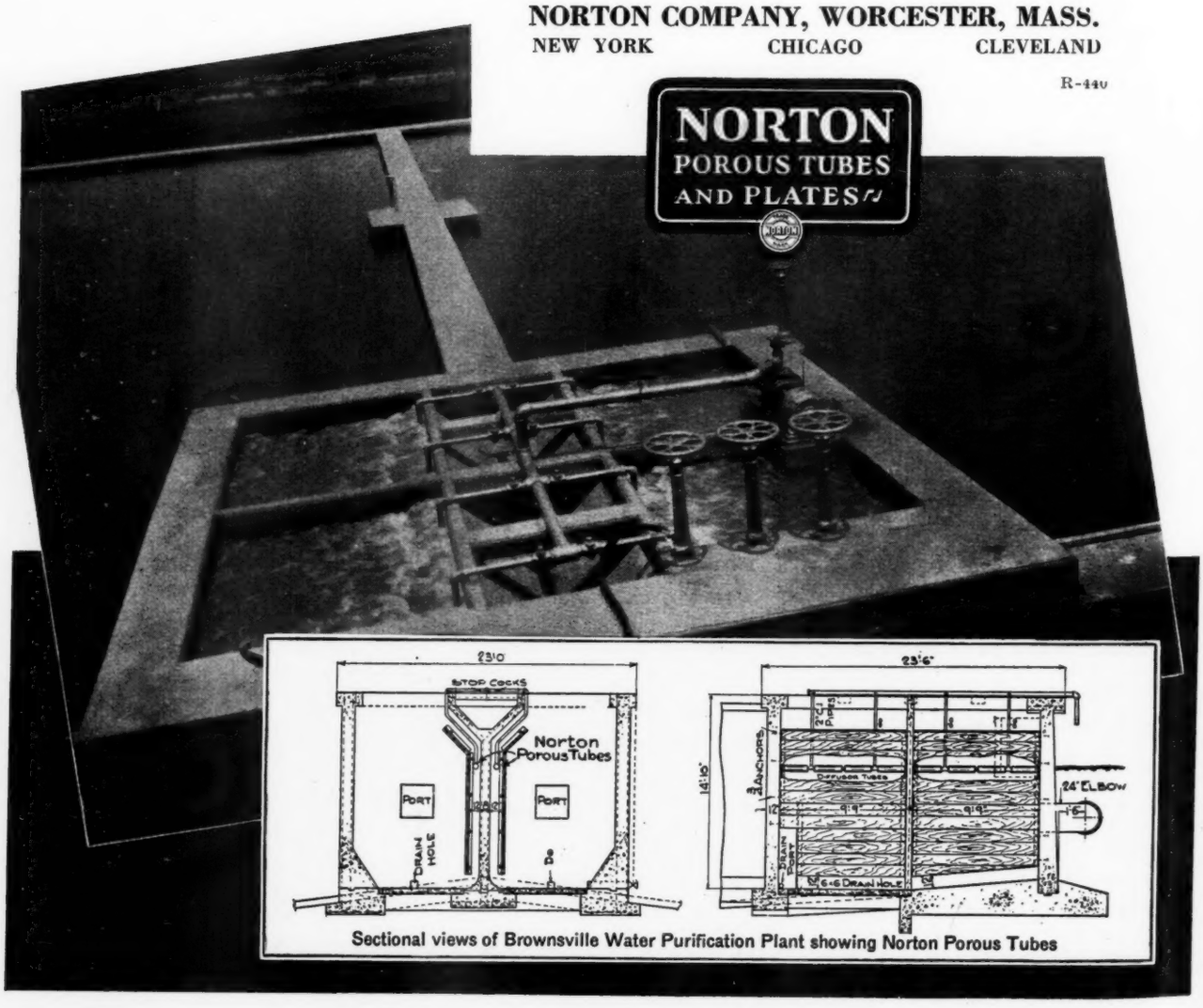

Sectional views of Brownsville Water Purification Plant showing Norton Porous Tubes

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CITY COUNTY STATE

AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 63 June, 1932 No. 6

Mechanical Equipment in Sewage Treatment Works

By A. Prescott Folwell

Editor Public Works

The most significant development in sewage treatment during the past five or ten years has been the increasing use of mechanical appliances, both for reducing the amount of hand labor necessary and for performing functions impracticable by hand —the latter being the more important. Air compressors and mechanical agitators for activated sludge plants, sludge and scum removers in sedimentation tanks, vacuum filters, revolving screens and various devices for handling detritus and screenings are a few which have been installed in many recent plants. And we are satisfied that the next few years will see more general use of these and other mechanical aids.

It seems worth while, therefore, to bring together and describe briefly, in a series of articles, what appliances are now available to sewage plant designers, since most of them are so recent that little if any mention of them has been made in the text books on the subject. In fact, some are so recent that the designers are not ready to have them announced publicly, but have promised to permit us to do so as soon as their interests will warrant. The first installment, dealing with appliances for grit chambers and coarse screens, is given in this issue.

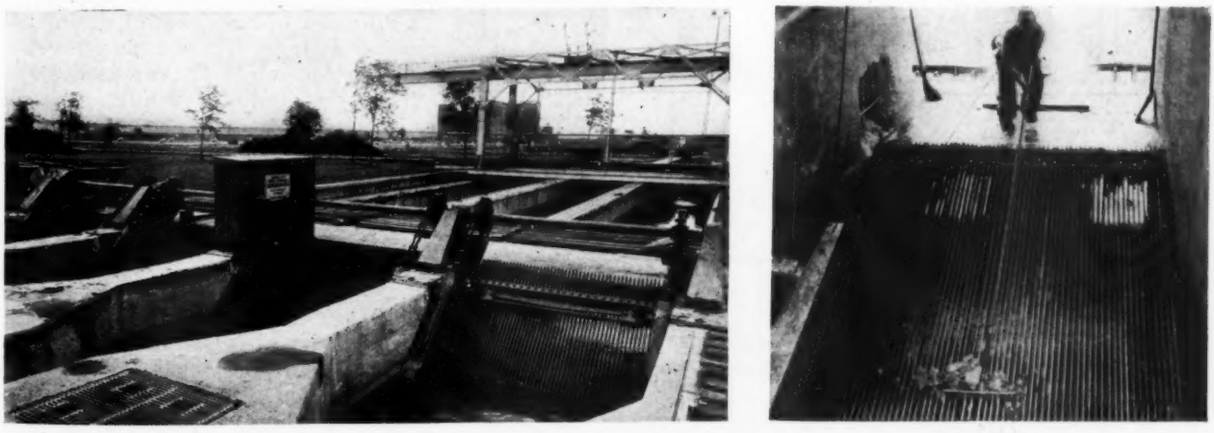
Grit Chambers and Bar Screens

RAIN water or flushing water from streets—even hard-paved streets—generally contains some mineral matter, and storm sewers and combined sewers therefore carry more or less of this at times. Sanitary sewers should not receive any, but many systems have dirt washed into manholes through ventilation holes and defective brick work, and through open pipe joints, and more or less ashes and other mineral matters are thrown into toliets; and though the quantities are small, where grades are flat and velocities low these solids may accumulate in the pipes, to be carried to the treatment plant in quantities when unusually heavy flow occurs.

Storm and combined sewers receive sticks, leaves, rags and other large objects; and rags, paper and similar objects are generally found in sanitary sewage.

Sand and other mineral particles cause rapid wear in pumps, and rags and sticks may clog them. Also all of these may settle in the sumps of sedimentation tanks and clog the mouth of the sludge pipe. While the latter is seldom a serious matter, it may cause operating difficulties and expense.

It is therefore generally necessary to provide for removing these objects if sewage is to be pumped; and desirable to do so if it is to be treated. But many



Mechanical equipment vs. hand labor in cleaning bar screens. On the left, a battery of mechanically cleaned "Dorrco" bar screens at the Calumet plant of the Chicago Sanitary District. On the right, a screen being cleaned by hand.

treatment plants receiving sanitary sewage only are operated successfully without pre-removal of either grit or large objects.

Grit Chambers

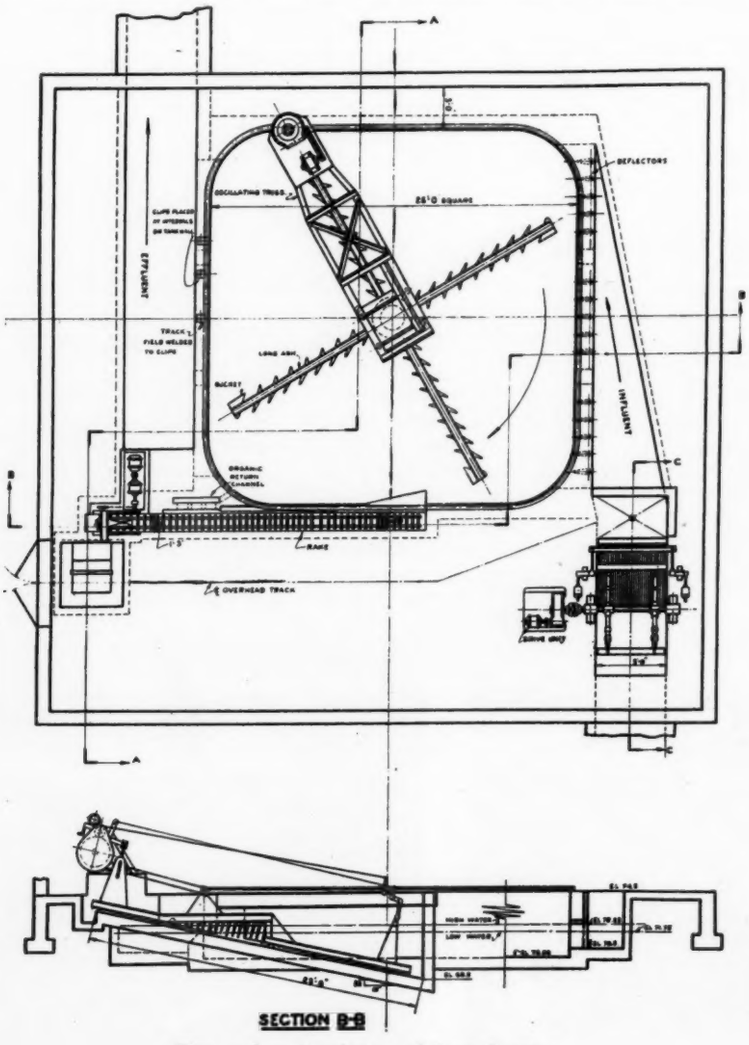
It is generally considered that all but very fine grit will settle out if the sewage has a velocity of one foot a second; but that if the velocity is less than this, organic matters also will settle out, and the presence of these mixed with the grit will make it difficult to dispose of the latter without nuisance. One foot is therefore the accepted velocity which sewage should have while flowing through a grit chamber.

As the volume of sewage varies from hour to hour and day to day, it is impossible to maintain a uniform velocity without complicated devices. The common practice is to provide two or more channels in the grit chamber, with weirs or gates so designed that when the velocity of flow in one channel exceeds about one foot per second, part of the sewage will be diverted into a second channel. Or an operator, watching the flow, keeps enough channels in service to maintain the velocity at about one foot in each. But even so, the velocity in at least one channel will generally be less than one foot and deposits of organic matter occur. A contrivance called a "detritor" has been devised to remove all mineral matter down to 0.21 or 0.15mm. in a clean condition, and deliver it outside the channel, all by mechanical means.

The silt which settles in a grit chamber or detritus tank must be removed. In most small plants, and some large ones, this is done by hand with shovels; in a few it is flushed out through an underground pipe leading from the bottom of the chamber. But most recent large plants have installed mechanical equipment for this purpose.

One type is simply a crane, either fixed or movable, which lowers into the grit chamber either a grab bucket, or one to be filled by hand, which then is raised and emptied into a truck. Another consists of a monorail mounted over the chamber carrying a bucket which can be lowered wherever desired. This is especially suitable for a long channel receiving deposits throughout its length, the bucket being lowered at intervals where the depositing occurs.

The detritor, previously referred to, contains a collecting mechanism in the bottom of a square grit chamber, which pushes the grit into a channel which slopes upward to a drainage deck. The grit is drawn up this inclined channel by a reciprocating rake cleaning mechanism, being cleaned and drained at the same time. The grit chamber is designed to collect all the grit at all times, and as this necessitates velocities below one foot part of the time, more or less organic matter will settle also, but will be washed out by the reciprocating rake and returned to the main sewage channel. It is said that the grit so removed need never contain more than 1½ percent of putrescible organic matter. This equipment operates continuously. It is manufactured by the Dorr Company.



Plan and sectional view of Dorr Detritor

A bucket elevator for cleaning small detritus tanks which at the same time cleans a bar screen will be described in connection with screens.

For the final removal of the silt to a storage pile or hopper, a monorail and bucket carrier, or a belt, bucket, scraper or screw conveyor may be used. Deposited in an elevated hopper, it can be loaded directly into trucks driven under it.

Some plants use pneumatic ejectors for removing the grit through a pipe to a distant point of deposit; as far as 1,000 feet with an 80-foot rise in one case. The air used for conveying is also used to clean the ejector and discharge pipe. Pneumatic Ejectors, Inc. has adapted these to several large treatment plants.

Bar Screens

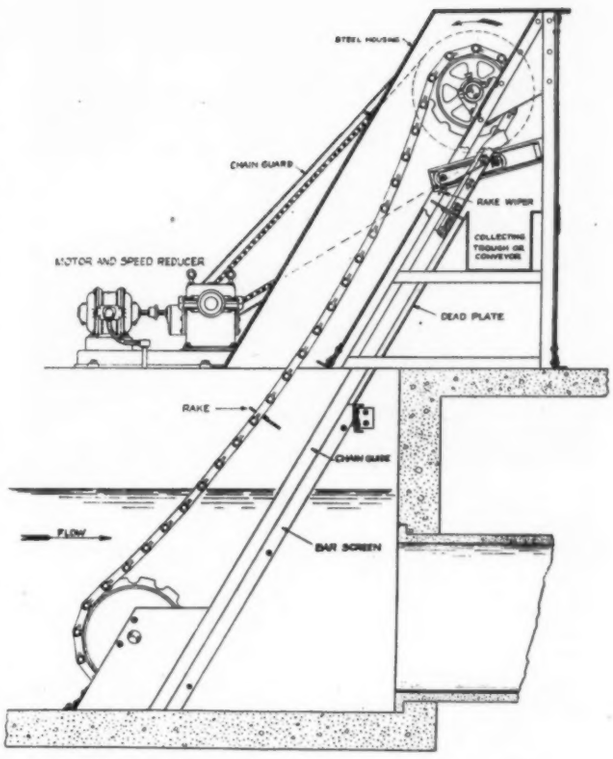
From the beginning of sewage treatment it has been the practice to remove large floating matters by means of racks or screens consisting of flat bars (or sometimes round rods) of iron or steel, or occasionally of wood. These are generally spaced

from ½" to 2½" apart, and set at an angle of about 30° with the vertical to facilitate cleaning. It is common practice to so design the screen that the total submerged area between bars theoretically will give a velocity of 3 ft. per second during maximum flow.

These screens originally were, and still are in many plants, cleaned by hand, using rakes. This is hard and disagreeable work and is generally neglected until made necessary by the clogging of the screen.

Several types of mechanically operated rakes for performing this service are available and coming into general use. There are three general types, two for use with the common flat screen and one requiring a curved screen. The more common type consists of a series of rakes, each horizontally spanning the full width of the screen, the ends of which are attached to a pair of endless chains which continuously move the rakes slowly upward over the face of the screen, carrying the screenings to the top of the screen, where they are dropped into a conveyor or bucket or onto a draining platform. The chains pass over sprocket wheels at the bottom and above the top of the screen, the upper pair being driven by electric motor or other power. Equipment of this type is made by the Dorr Co. and the Chain Belt Co.

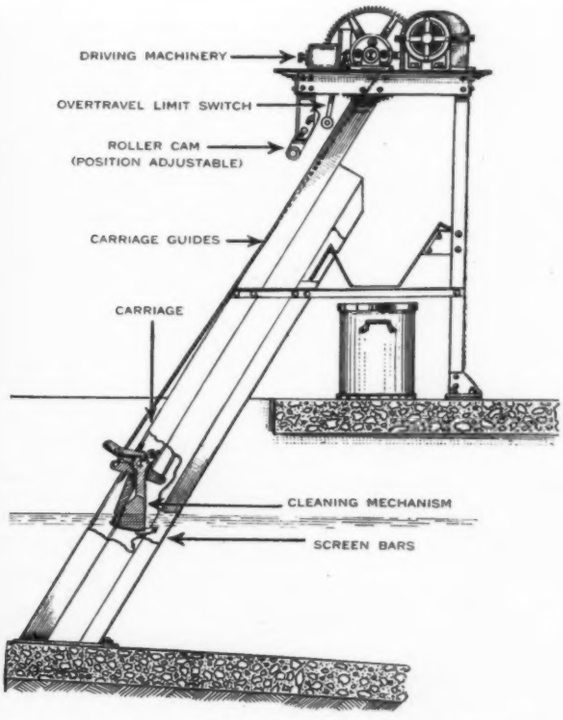
In the second type a single rake moves up the screen, delivers the screenings there, is withdrawn horizontally so as to clean the screen, and descends to the bottom again. In a screen of this type made by the Link Belt Co. a rake-bearing carriage moves up and down in front of the screen, the pull of the hoisting cable holding the rake in engagement with the screen bars during upward travel, while the weight of the carriage on the lowering cables holds the rake clear of the screen during downward travel. The rake travels at a rate of about 7 ft. a minute and can be adjusted to operate at intervals of from four minutes to an hour, the stop being made while the rake is at the top of the screen.



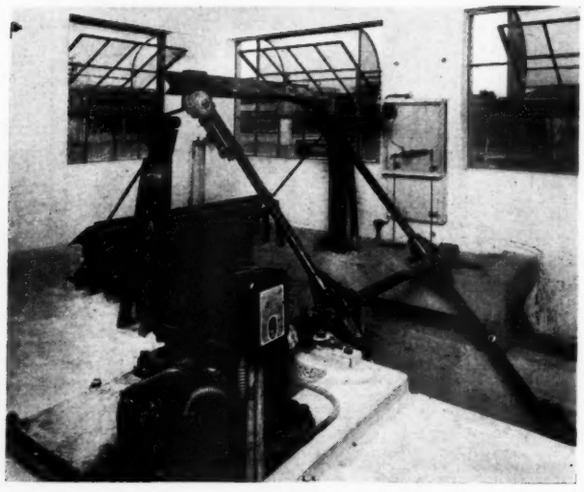
"Rex" (Chain Belt) mechanically cleaned bar screen

A reciprocating rake operating in an entirely different way is made by the Dorr Company. The rake

Straight Line screen at Sugar Creek plant, Charlotte, N. C.



Straight Line (Link Belt) mechanically cleaned bar screen

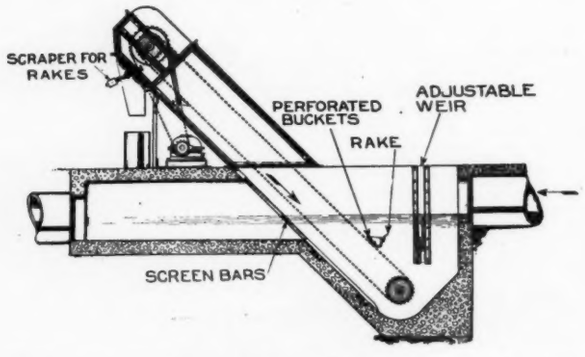


Dorrco bar screen at Fort Worth, Texas

is carried on one arm of a jointed frame which operates on the pantograph principle, the path followed by the rake being a rectangle with rounded corners, the rising side of the rectangle coinciding with the face of the bar screen, while the parallel descending side is several feet from it. As in the case of other screen mechanisms, provision is made for removing the screenings from the rake at the top of the up stroke.

The third type consists of rakes which revolve about an axis and engage the bars of a screen which is curved to a radius having its center in the same axis. In the Dorr screen of this type two rakes, having the form of indented plates with a length equal to the width of the screen, are fastened to the ends of two parallel arms revolving around an axis passing through them at mid-length. As the arms revolve, the rakes in turn move upward across the screen, removing the screenings; and when they pass the top of the screen, a scraper bar attached to a rocker arm removes the screenings from the raking plates onto a draining floor or a receptacle.

A combined screen and grit chamber cleaner for small plants is made by the Link Belt Co., consisting of an endless chain bucket elevator, working in the hopper-shaped bottom of a grit chamber, at the downstream side of which is an inclined bar screen. The downward-moving half of the chain parallels the screen at such a distance that rake teeth set in the lips of the elevator buckets engage with the screen bars



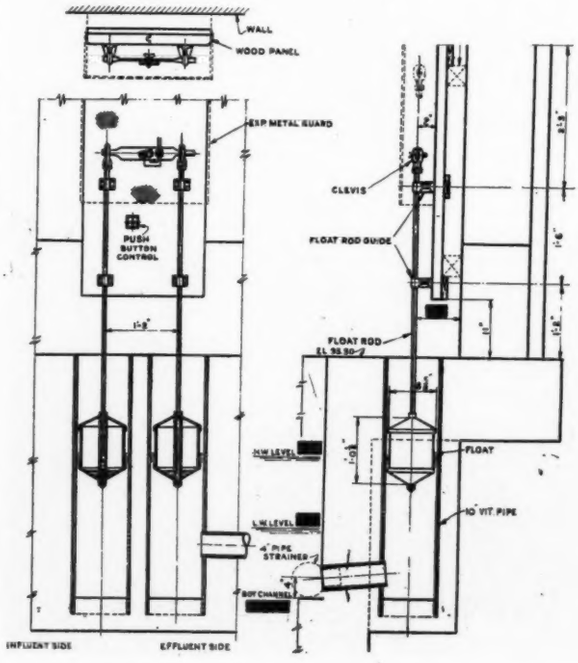
Combined screen and grit chamber—Link Belt Co.; for continuous or intermittent operation

and carry the screenings down with them. At the bottom turn the buckets just clear the curved bottom of the grit chamber and pick up the contained grit, and then carry both grit and screenings (which drain meantime through holes in the buckets) to the top, where they are discharged. This is suitable for plants where both screenings and grit are buried or otherwise disposed of together.

Where screen cleaning mechanisms operate continuously, probably at least seventy-five percent of the passages of the rake across the screen are unnecessary, since during a very large part of the time the amount of screenable matter in the sewage is much less than the maximum for which the rake was designed. In fact, continuous cleaning may be undesirable, for it has been stated that a light load of screenings on the screen increases its efficiency, causing it to retain small matters that otherwise would pass through it. The Dorr Company furnishes an automatic float control which energizes the motor circuit operating the rake, of whatever type, when sufficient screenings accumulate to hold back the sewage above the screen and produce a predetermined head above the level of the sewage below the screen—a head of about 2 inches is that commonly chosen; and when the removal of the screenings permits the lost head to return to normal, the current is cut off and the raking mechanism stops.

In most small plants the screenings are deposited on a draining platform at ground level or in cans, wheelbarrows, etc., to be removed at intervals by hand. In large plants, belt or other conveyors are used or the screenings are deposited in hoppers for intermittent removal by trucks. In a plant recently completed for the Westchester Sanitary Sewer Commission by the Municipal Sanitary Service Corporation, large pneumatic ejectors are used capable of passing a 2x4 timber two feet long.

In the next installment we will deal with sedimentation and digestion tanks.



Sectional view of Dorr automatic control switch

Large Crusher-Run Stone Used in Mixed-in-Place Tar Road

By Harold L. Tilton
Vermont Department of Highways

THE Vermont Department of Highways constructed in 1931 a section of mixed-in-place surface 4.79 miles long in the town of Concord on Route U. S. 2, which is one of the best tar mixed-in-place surfaces constructed during the year.

There are several interesting features in connection with this work. First of these is the size of stone used. The surface is three inches thick, built on a gravel base. Instead of limiting the maximum size of stone to that which would pass a 1½ inch circular opening, which is customary in most mixed-in-place specifications, the stone used in the mix was crusher run material passing a screen with circular openings 2½ inches in diameter and retained on a screen with circular openings ¾ inch in diameter. There was no difficulty in mixing and spreading stones of this size, and the use of the larger stone reduced the cost. Where a crushed stone surface is constructed on a gravel base, it appears advisable to limit the size of the largest stone to about three-fourths of the depth of the surface course.

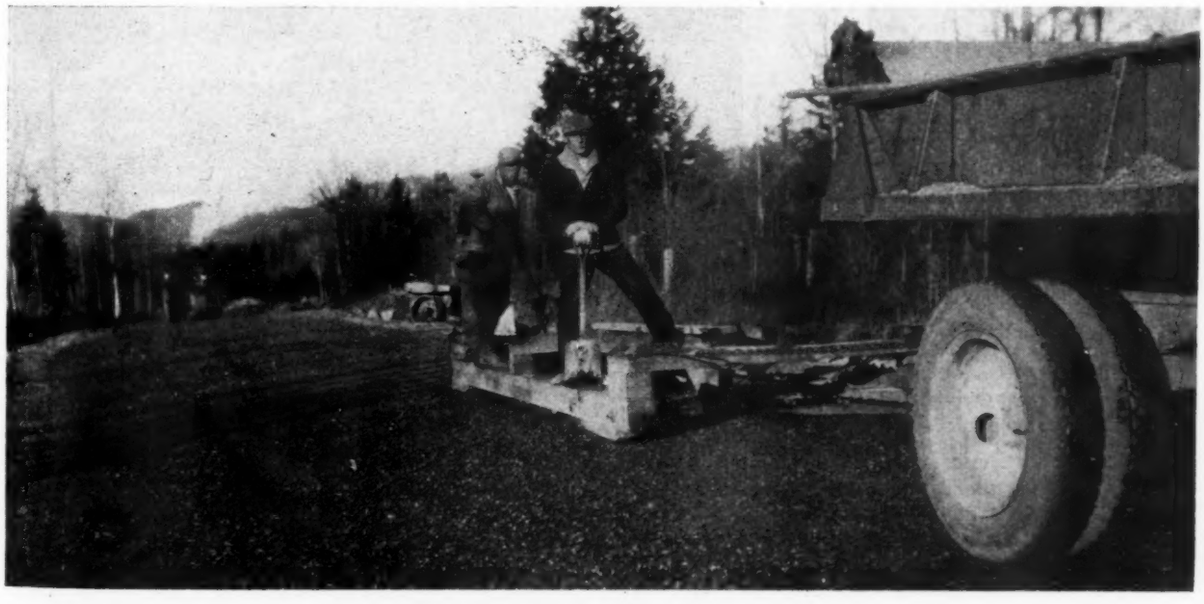
Another interesting feature is the fact that a surface of angular crushed rock was built out of crushed stones from a till bank. The stones occurred as "plums" in this bank, the fine material being unsuitable. There was a fine silt coating on many of these stones. There were very few small stones in the bank. All the material passing a one inch mesh vibratory screen was wasted or used to true up the gravel base. The stones which were crushed were of such size that the percentage of round pieces was negligible, with the result that the surface was composed of angular pieces of stone.

Another important factor was the use of a prime coat on the subgrade, which served the triple purpose of providing a cut-off for capillary moisture, of preventing the inclusion of undesirable material from the base into the mix, and of eliminating the dust nuisance to traffic.

At the bank, the material was excavated by a power shovel. The stones were crushed in a 24x40 primary jaw crusher followed by a secondary 10x40 jaw crusher, both made by the Acme Road Machinery Co. All material passing a vibratory screen with ¼-inch mesh was rejected and used in the sub-base. The crushed stone was washed in a scrubber section and screened to two sizes: ¾"—2½" for the mix, and ¼"—¾" for the seal. The stone is a crystalline schist and has an appearance similar to trap rock and a percent of wear of 2.5.

On the road the construction was as follows: The gravel base was carefully brought to grade and cross-section by a power grader. A prime coat of tar of 10 viscosity was then applied at the rate of 0.25 gallon per square yard. This was applied for half the width of the road and allowed to penetrate. No cover was used, and traffic was kept off it until the penetration was complete, when the other half was treated. In late October, frequent rains left the subgrade too damp toward the end of the work for satisfactory penetration, with the result that the prime coat broke up badly under traffic. This was overcome by adding 0.2 gallon of 40 viscosity tar and building up by covering with sand.

Stone for the mix was spread on the primed surface by the use of Burch spreader boxes. On this



Smoothing and rolling the seal coat on Route U. S. 2

stone, the first application of tar was made at 0.6 gallon per square yard. This was a high-carbon Tarmac, 9-12 percent carbon, with a viscosity Engler 50° C of 40-45, which was purchased from and applied by the Koppers Products Company. The stone was then mixed by windrowing with blade graders drawn by tractors. A second application of 0.33 gallon followed, and the stone was spread smooth, to a true cross-section. It was immediately rolled to a limited extent by three-wheel power rollers of 10 to 13 tons. Rolling ceased as soon as the surface was true and the stones were embedded sufficiently to resist displacement by traffic. The following day the surface was thoroughly rolled, and back rolling continued from time to time. A double-dragged seal was constructed during the first part of the project but was abandoned and a single seal was substituted, due to the fact that the weather was too cold to permit satisfactory manipulation of the tar coated stone. In the construction of the double-dragged seal, a tack coat of tar was applied on the surface at the rate of 0.2 gallon per square yard. This was covered immediately with pea stone to a depth of ¾". These were spread smooth by a drag 20 ft. long containing blades in zigzag arrangement. An application of ¼ gallon of tar was immediately made on the stones, which were then mixed and smoothed with a drag as before. Immediately following this, the surface was thoroughly rolled.

In the construction of the single seal, a single application of ¼ gallon was made and this was covered with pea stone at the rate of approximately 175 cubic yards per mile. These stones were distributed evenly over the surface by the drag and immediately rolled in place. The use of such a drag for this purpose requires that the blades of the drag be set approximately ¼' higher than the shoes in order to prevent any tearing of the stone surface below. This surface has proved very satisfactory. It was built at a cost of $6172.15 per mile.

A small drag, 12 feet long, which can be drawn by a light truck is used in retreatment work, but for new construction where three inches of loose gravel is to be mixed, it is necessary to use a long drag, which requires a five-ton tractor or a four-wheel drive truck to pull it under such conditions. For such work as is described in this article the author prefers a long drag for the simple reason that it makes a smoother road. A three-ton truck will haul it on such work.

William H. Chase was resident engineer, and Frank Calkins was superintendent in charge of construction for the State Highway Department. This work was done under direction of H. E. Sargent, commissioner of highways.

Six Standpipes for Bath Water District

The Bath (Maine) Water District, in connection with the enlargement of its system and supply, planned to erect a bank of six standpipes on a lot 200 feet square, a little over a mile from the center of the city and one of the highest elevations therein. This, say the trustees in their annual report, "is in line with the best modern engineering practice, which recommends the use of a number of small standpipes placed at different points in the distribution system, in preference to one large standpipe." A new 16-inch Universal pipe, cement lined, connects these with the center of the business section. Two of these standpipes have been built, each holding 890,000 gallons and costing $12,100 exclusive of foundation.

Another important work described in the latest report is the laying of 765 feet of submerged pipe across New Meadows River. The pipe used was 12-inch Universal cement lined, with a double coating on the outside and cadmium bolts. This was supported on piles. Tests made through a ⅝ inch water meter each day showed the line bottle tight.

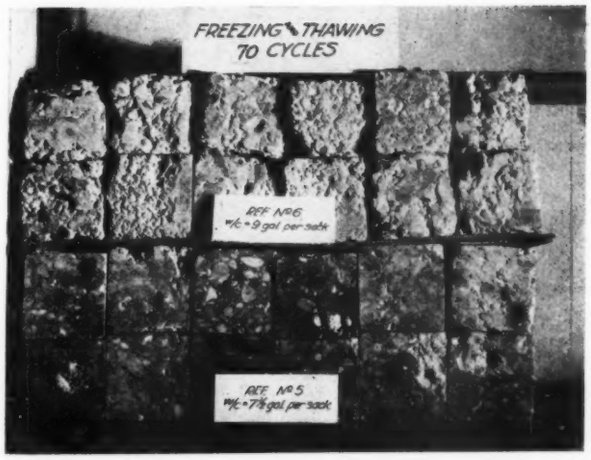
Top—After receiving prime coat. Middle—Mixing the surface material. Bottom—Surface course before the seal.

Practical Details of Concrete Construction

By William E. Barker
Highway Engineer, Portland Cement Association

MOST recent graduates from engineering courses are well up—not to say "fed up"—on the theories of structures. They can design the proportions of a wall, dam or road of concrete with more or less warranted confidence. But if told to go out on the job and pass on the coarse and fine aggregate, decide what proportions of them and of cement and water will be best for the particular structure in mind, and direct the thousand and one details on the job necessary to carrying out the plans—well, that is something else again.

Having this in mind, we have asked William E. Barker, engineer with the Portland Cement Association, to describe these practical details in a series of short articles which will, we hope, be found a real help to engineers and inspectors who are new to this important feature of engineering construction.



Conditions of cubes of 1:2:4 concrete of different water ratios (9 gallons per sack and 7½ gallons) after 70 freezings and thawings. Low water ratios recommended for severe exposure.

The Fundamentals of Concrete Making

The fundamental characteristics of concrete are strength, durability and watertightness. It is with these characteristics and the means for obtaining them that this article deals.

Concrete is fine and coarse aggregate held together by hardened cement paste. Although the aggregates have some effect on the characteristics of the concrete, the paste is the active element and governs its useful properties. If strong concrete is desired, the paste must be strong. If the concrete is to be watertight, the paste must be watertight. The paste thus becomes the first consideration in the study of fundamentals.

Only about 2½ gallons of water is required to hydrate a sack of cement. It is, however, necessary to use considerably more water than the quantity required for hydration because the paste must be somewhat fluid to make intimate contact with the surfaces of the aggregate, and the concrete must have a certain degree of workability to eliminate honeycomb and assure the filling of corners and a bond between concrete and steel.

The strength of concrete for different quantities of mixing water per sack of cement has been determined by test. It is thus possible to produce a concrete of a desired strength by using a paste of the right dilution and then adding to it sufficient fine and coarse aggregates to make a concrete of the desired consistency and workability. There are several ways of determining the quantities of aggregate which can be added to the cement paste and these will be discussed in a later article.

Since concrete is primarily an outdoor material, durability is frequently more important than strength. Durability is ability to resist the natural forces of disintegration, such as freezing and thawing. A durable concrete is one in which durable aggregates are surrounded by a durable paste. The durability of aggregates is determined by tests, or by visual examination. A durable paste must be strong, to resist stresses that might cause disintegration, and watertight to exclude fluids which might cause such stresses or otherwise damage the concrete. A strong, watertight paste is secured by using the correct ratio of water to cement and by proper curing.

Observation of concrete in service indicates that for durability under extreme exposure the mixing water should not exceed 5½ to 6 gallons per sack of cement, for severe exposure 6 to 6½ gallons; moderate, 6¾ to 7½; and for indoor concrete 7½ to 8¼ gallons. In each case the smaller quantity applies to thin sections, such as light walls, and the larger quantity to heavy walls, piers and dams. At least 10 days of moist curing at 70°F. is assumed, as well as proper mixing and placing and a concrete in which the cement paste completely surrounds the aggregate particles.

Curing means the protection of concrete from rapid drying. Cement particles hydrate slowly and must be kept in contact with moisture during the hardening period. If the concrete is allowed to dry out, hydration nearly stops and the cement paste does not attain its full strength. In addition, the evaporating water leaves pores in the concrete which may later fill with moisture. If loss of moisture is prevented the water combines with the cement to form solid matter that fills these pores and reduces the possibility of subsequent absorption. Curing thus increases durability by increasing strength and watertightness.

Curing is accomplished by covering the concrete with some wet or impervious material.

Watertightness of the concrete is distinct from watertightness of the paste. It requires a watertight paste and also freedom from voids through which fluids might find their way. A concrete which is harsh and unworkable can not be watertight for it is sure to have in it honeycombed spots or rock pockets where lack of mortar has left unfilled spaces between the aggregate particles. Nor can too wet a concrete be watertight, because then the paste itself would not resist the passage of water and in addition segregation would result in stony areas or pockets consisting largely of laitance, through which water would readily pass. The first requirement for watertightness is, then, a plastic, workable concrete, neither too dry nor too wet, with ample cement paste to surround the aggregate particles.

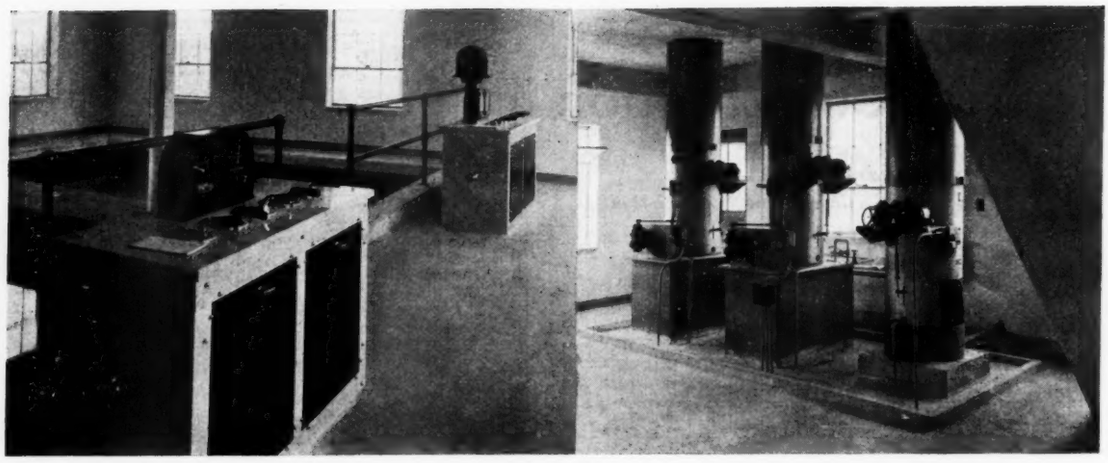
After the concrete leaves the mixer it must also be so handled that segregation is prevented and laitance is eliminated. After it is in place it must be puddled or otherwise compacted to eliminate air and water pockets, through which water might later find its way.

Laitance is a layer of the finer particles in the cement and aggregate, brought to the surface by water. It is an enemy of durability because it possesses very little strength and is rapidly disintegrated by weather or water.

Some laitance forms whenever water rises to the surface of unhardened concrete. Its amount depends upon the quantity of water coming to the surface and the amount, size and weight of fine particles in the concrete. A wet concrete is conducive to laitance, as is a fine sand or an aggregate containing silt or earth. A very coarse sand may result in laitance because water "bleeds" from it easily. Overfinishing may work excessive fines and water to the surface.

Laitance is prevented by using clean aggregate, a sand which is neither too coarse nor too fine and concrete of such workability that a minimum of mixing water and finishing is required. In pavements, laitance is remedied by scraping excess mortar from the surface; in structures by removing the top of the previous day's work before depositing fresh concrete, or by overfilling the forms, when the top is reached, so that water coming to the surface spills over the sides.

The fundamentals of concrete making are, then, the selection and proper proportioning of durable aggregates; the production of a cement paste of the desired strength and watertightness; and mixing, placing and finishing so as to maintain an even distribution of ingredients throughout the entire mass. When such a concrete is kept damp and warm during the hardening period, satisfactory service is assured.



Operating tables and filters of the Thomasville softening plant

At left, quick-lime slaker. Center, soda ash machine. Right, alum machine

Water Softening at Thomasville, Georgia, Saves More Than Double Its Cost

By Lowell Cady

With Wiedener & Singleton, Consulting Engineers, Atlanta, Ga.

THOMASVILLE, Ga., located near the Florida line, with a population of about 15,000, is the first municipality in the Coastal Plain section of that state to soften its public water supply. The water, obtained from deep wells, has a hardness of about 12 grains, which is reduced to 4 grains. Three wells have a combined capacity of 1250 g. p. m., but only two, with a total capacity of 950 g. p. m., are used at present.

After considering the relative advantages, costs, etc., of the zeolite and the lime-soda processes, the character of the hardness and other local conditions at Thomasville indicated the choice of the latter for softening to 5 grains, or 85 p. p. m. hardness. In order to remove the magnesium and produce a low final carbonate hardness, the water is over-treated with lime to 40 p. p. m. caustic alkalinity, followed by recarbonation to convert the caustic alkalinity to carbonate alkalinity, and then by filtration to remove the carbonates.

Description of the Plant

The softening plant consists of two mechanical agitators, one clarifier, three carbonating chambers, one settling basin, two gravity filters, all constructed of reinforced concrete, and a three story brick and reinforced concrete building.

The untreated water is pumped from the wells to the two rectangular mechanically agitated mixing tanks and enters through 8-inch openings in the sides of the tanks at the bottom, thus imparting to the water an initial peripheral velocity. Lime is added in one mixing tank and soda ash in the other. The tanks are normally operated with a split feed arrangement and, at the same time, in series; that is, the lime tank takes a portion of the water, the soda ash tank the balance, and also the portion from the lime tank. Or a parallel operation can be accomplished. The mixing period at 1.5 million gallons daily rate is 34 minutes, with a velocity of one foot per second. Water is drawn off at the top near the center of the tanks.

From the mixing tanks, the water flows to a Dorr clarifier which provides a sedimentation capacity of one and a half hours at normal rate. About 95 per cent of the precipitated material settles out in the clarifier. The mechanism is operated about two hours daily, after which the sludge is drawn out by cracking the drain valve. This operation wastes approximately 5,000 gallons daily.

From the clarifier, the water flows over a weir into a collecting flume, where aluminum sulphate is added, and then is led to the carbonation chamber, located at the influent end of the sedimentation basin, where carbon dioxide gas is applied to convert the excess causticity to the insoluable carbonate form and soluble bicarbonate form.

The water then passes through a 4-hour sedimentation basin, where the precipitate is allowed to settle assisted by the aluminum sulphate previously added. From the sedimentation basin, the water flows through a second carbonation chamber (which, at present, is not used) to two conventional gravity filters, each of ¾ million gallons capacity when operated at two gallons per minute per square foot of sand area. The water is then passed through a small carbonation chamber, where carbon dioxide gas is introduced to secure stability and, after this final treatment, the water flows to the clear well.

Chemical Feed

All chemicals are purchased in bags, in carload lots, and are conveyed by an electric elevator to the third floor of the plant, where the charging hoppers of the dry feed machines terminate.

Three dry feed machines for handling quicklime,

soda ash, and aluminum sulphate are located on the second floor; 58% soda ash and 17% alum being used, and quicklime ground to pass a ½-inch screen and having 96% CaO content. The cost of the quicklime is less than hydrated lime and, because of its greater calcium oxide content, it effects a saving in cost of approximately 30% over the use of hydrated lime. When handled in jute lined bags, it is no more inconvenient to use than hydrated lime. Loss from air slaking is negligible where storage does not exceed six weeks.

Slaking of the quicklime is accomplished in a simple and effective continuous slaker. The temperature in the slaker is controlled by the amount of water passing into the slaker.

Carbon Dioxide Equipment

Carbon dioxide is obtained from the power house stack. A wet and a dry scrubber are located at the stack and the suction pipe is connected to the breeching near the stack. An Ingersoll-Rand compressor, having a capacity of 100 cubic feet per minute, is located in the softening plant, which is about 200 feet from the scrubbers, and takes its suction from the scrubbers and discharges the gas into the two carbonating chambers. The compressor operates at constant speed and any change in carbon dioxide requirement is made by regulating an air dilution valve located at the compressor. The wet scrubber uses untreated water from the deep wells at about 12 gallons per minute, all of which is wasted.

Wash Water and Auxiliary Water

There is a 50,000-gallon elevated wash-water tank, which is filled by a 200 g.p.m. motor-driven centrifugal pump, so arranged that either treated or untreated water can be pumped to this tank. At present, untreated water is used for washing purposes; also in the dry feed machines and as cooling water for the compressor, but this is turned into the mixing tanks and so is not wasted as is the wash water, water for sludge removal and scrubber water. (Approximately 6.6% of the untreated water pumped is wasted in plant operation).

Laboratory Control of Operation and Results

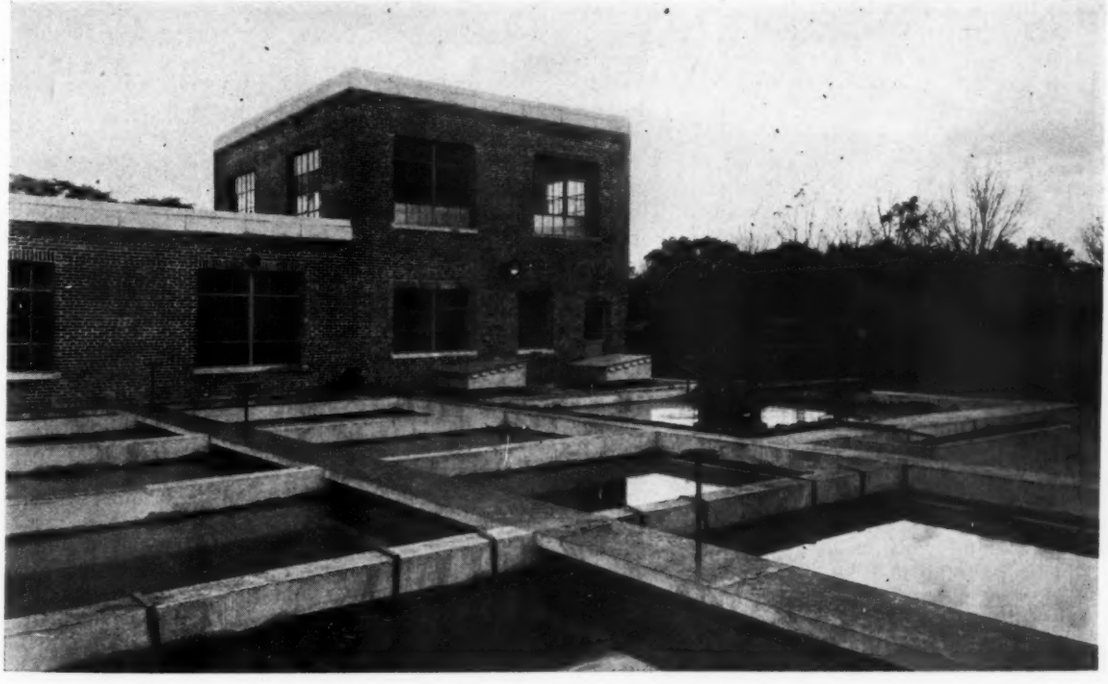
A laboratory on the second floor of the main building is equipped to run all the necessary control tests connected with the lime-soda process of water softening. Here charts are kept for ready use, showing the required dry-feed machine settings for the various rates of flow, the alkalinity-pH relationship curves, and a few other charts which help the operator in his work.

The table below shows the range and optimum values to give a final 4-grain hardness at three of the five major control points, as indicated by recent studies:

	RANGE Values p.p.m.	OPTIMUM Values p.p.m.
STATION NO. 1—(Outlet to the clarifier)		
Phenolphthalein alkalinity	50 to 60	55
Total (methyl orange) alkalinity..	60 to 80	70
Resulting causticity	35 to 45	40
STATION NO. 2—(Near influent end of settling basin)		
Phenolphthalein alkalinity	20 to 25	22
Total (methyl orange) alkalinity..	45 to 55	50
Bicarbonate radicle	4 to 6	5
STATION NO. 5—(Finished water)		
Phenolphthalein alkalinity	4 to 8	6
Total (methyl orange) alkalinity..	28 to 32	30

The non-carbonate hardness, as obtained during the same time, was about 38 p.p.m. This, added to the total alkalinity, gives a total hardness in the finished water of 68, which was checked in the laboratory by the soap method.

The water leaving the filters has a pH value of 9.1 which, for an alkalinity of 30, is too high for stability. In order to lower the pH and insure stability, a small



General view of Thomasville plant, looking toward clarification and mixing tanks

amount of carbon dioxide gas is added in the final carbonation chamber, as previously mentioned.

The general contractor for the plant was Prince E. Jinright, Thomasville. The contract for the filter equipment, chemical feed, piping, etc., was let to Burford, Hall & Smith of Atlanta, Ga., and that for the dry feed machines to the Omega Machine Co., Kansas City, Mo. The engineers were Wiedeman & Singleton, Inc., of Atlanta. The total cost of the plant was about $46,000.

Cost of Operation

The total cost per million gallons for the month of January, 1932, was as follows:

Lime	$10.21
Soda ash	3.80
Aluminum sulphate	.82
Total chemical cost	$14.83
Water (washing & miscl.)	1.97
Power	2.92
Labor	6.05
Supplies and oil	.14
Interest on investment	8.91
Depreciation	4.23
Total operating cost per million gallons	$39.05

The average reduction in hardness for the month of January was about 7½ grains.

Saving Due to Soft Water

Softening this supply effects a saving in soap and bills for repairing water services and appliances due to incrustation and in the amount of salt required for the industrial and municipal zeolite plants in use in the city. The soap saving is estimated at $25,500, based on the use of 0.1 lb. of soap per part per million of hardness removed per 1,000 gallons, and the use of 3 gallons per person daily for bathing and laundering. Saving in the repair bills is estimated at $3.50 per service per annum, or $7,000. Saving in salt is estimated at $1,825. This gives a total saving of $34,325. As the operating cost is $11,000, the total saving to the customers is $23,325.

In addition to this financial benefit, there is to be considered the personal comfort and convenience which the community derives from the use of what is classed as soft water.

The above is condensed from a paper before the Southeastern section, American Water Works Association, by Mr. Cady, who expressed his appreciation to D. Rhett Pringle, superintendent of water and light, Thomasville, for the data furnished and the courtesies rendered in the preparation of the paper.

Modern Equipment Effects Economy in Laying Water Mains

"Operating Economies of Water Works Systems" is the title of a paper by W. E. Macdonald, water works engineer of Ottawa, Canada, before the Canadian section of the American Water Works Association. Part of this paper was devoted to consideration of economies in laying water mains, with the following suggestions:

When excavating preparatory to installing water mains, proper supervision will prove a great saving to a community. If the work to be carried on is a fairly extensive one, then by far the most economical way of excavation is by using trenching machines. These machines, using only a very few, will accomplish much more work at a greatly reduced rate than it is possible to do by hand; but when it is required to excavate only a short section of trench, then the manual labor is cheaper, as the cost of moving and setting up the trenching machinery would overcome the difference in actual cost of excavation.

Proper appurtenances are a great necessity for economical excavation. For instance, where it is necessary to cut a pavement or hard macadamized surface it has been found that the cut can best be made with pavement breakers operated by compressed air. The air compressor is one of the most useful appurtenances in the possession of the water department, as it solves many difficult works and accomplishes same within a minimum of time.

It is false economy to attempt to accomplish work by the use of antiquated machinery or tools and the water department will find that, by maintaining all appurtenances and tools in first class condition, the work can be accomplished within a minimum of time at a greatly reduced cost.

It will be found much more economical to make plenty of room for working conveniently around the pipe. In this way much time is saved in the actual laying of the pipe and will allow for proper backfilling where the material will slip past the pipe and fill the lower section beneath it. If the trench is cramped for width, then the backfilling material is likely to arch and rest on the top of the pipe, causing an undue strain and possible breakage.

Where lead is used for making the joints, most municipalities have adopted the use of jack hammers and compressed air for caulking of all joints. This method of caulking is far superior to the former practice of caulking by hand, inasmuch as it speeds up the work and produces a much better quality of joint and at less than twenty-five per cent of the former cost.

In recent years it has been possible to effect savings in the installation of pipes in the distribution system by the adoption of one or more of the many lead substitutes or jointing compounds. These jointing materials greatly decrease the cost per joint in entirely eliminating caulking and making it possible to successfully install the cast iron pipes without the necessity of providing additional excavation areas at bell holes, as formerly required for caulking of joints. Records taken recently on the installation of a short line of 36″ cast iron pipe in this city showed that the cost of completing the joints with lead was $18.06, whereas the same joints were completed by the use of one of the jointing materials at a cost per joint of $4.42, thus showing a saving per one hundred feet of pipe installation of $109.12, plus the additional saving effected in the lesser quantity of material required to be excavated.

As against this saving in initial cost of main laying the engineer has to carefully consider the many merits of the use of lead as a jointing material. . . . The past summer witnessed the greatest number of fractures in our distribution system during the past twenty years and it is a matter of record that not one break occurred in close proximity to a lead caulked joint.

Sewage Treatment Without Bacterial Action

A plant in the commercial district, all under roof, in which all sewage solids and gases are incinerated; and cinders, odorless air and chlorinated clear effluent are the only products

THE writer has just visited a most interesting municipal plant—the latest thing in sewage treatment works, of which he is privileged to be the first to give a public description. While most of its features are the development of ideas which have been introduced and tried out individually during the past ten years, this plant at Nirgend is the first to combine them all successfully.

The plant is housed in an attractive building, occupying practically all of the basement and a small part of the ground floor; the front of the ground floor and the several floors above being leased for commercial purposes. There was no sight or odor to suggest sewage. In fact, the air was remarkably fresh.

The several pieces of equipment are enclosed in housings of white enameled steel, with glass windows occupying about a quarter of the area of the enclosing walls; these and electric lights inside being so placed that all operating parts of the equipment can be seen plainly.

The engineer in charge, Mr. Nemo (who holds both state and federal license as a Class A sewage plant operator), explained to us that all operation of the plant that is not continuous is automatically controlled, which makes possible the housing, the purpose of which is to absolutely prevent the escape of any odors into the building. At one end of the plant is an incinerator and chimney, and air which is drawn continuously through all the housings is blown into either the chimney or the incinerator, the latter when odors are probable, as when cleaning the units. This large basement room contains all the plant except the upper part of the incinerator and the appliances for dewatering the screenings, which are on the floor above, in the rear. The entire plant is in three similar parallel units, each having capacity for treating half the maximum sewage; while room left for a fourth unit (to provide for growth of the city) is utilized for testing out suggested changes to the present equipment or improvements to be embodied in the enlargement when this becomes necessary. (This experimental plant has enabled Mr. Nemo to develop several improvements, with comparatively little cost to the city.) At the entrance to the plant is a gate by which the sewage can be directed into either one or two of the operating units; and should an obstruction, breakage or other condition occur at any part of the plant making it desirable to stop operation, the entrance gate is automatically operated and the sewage diverted from this unit into the idle unit of the plant, while a bell is rung calling the attendant's attention to the location of the trouble.

Much of the equipment we could identify, but we saw no large tanks. Mr. Nemo explained: "For fifty years almost all developments in this field were based upon the idea of utilizing bacterial action. But this action requires weeks or months, during which time the organic matter must be stored in the plant—hence large Imhoff or sludge digestion tanks. We have eliminated bacteria entirely as agents in our purification process—all solids removed are immediately destroyed in an incinerator; as are all odors, of which there are very few.

"As to precipitation tanks, we substitute for these

How Part of Two Units of This Plant Looked Before the Housings Were Installed

No photographs of the Nirgend plant were obtainable. The above, showing a pair of detritors at Hamilton, Ont., with grit collecting tanks in the foreground and grit cleaning channels in the center background, gives an idea of how part of the plant looks with the housings removed.

screens, coagulation and filters. For years it used to be said that the real problem in sewage treatment was to get rid of the solids—the sludge. Really it is no problem at all. Our solids reach the incinerator with about 60% moisture content, and burn themselves. At first we burned screenings with 80% moisture, using oil fuel, but we find further dewatering and self-combustion much less troublesome and no more expensive."

The process may be described briefly as follows:

The sewage, on entering the building, passes through bar screens and a grit chamber; then through a fine screen with 3-16 inch slots; then is treated with a coagulating (or it might be termed an agglomerating) substance, mixed thoroughly and passed through a finer screen of special construction, and leaves this clearer than the effluent of most sedimentation tanks. If at any time the effluent should not be up to a predetermined standard of clarity, it is automatically diverted to another channel where it is again coagulated and passed through a centrifuge filter. The final effluent is chlorinated and discharged into the stream. The entire loss of head through the plant is less than two feet.

The screenings are removed automatically from the bar screen by a mechanical cleaner and deposited on a belt which carries them to and deposits them in the incinerator; the water meantime draining off and flowing back into the main sewage channel. This screenings remover operates only when sufficient screenings have accumulated to make this desirable, starting automatically and stopping when the screen is clean.

The grit deposited in the grit chamber is washed and elevated onto another conveyor, which carries it to an elevated hopper, outside the building in the rear, under which trucks can drive to receive it.

Screenings from the fine screens are brushed into the hoppers of pneumatic ejectors which discharge them into a series of hoppers on the floor above that feed vacuum filters in two of the units, while centrifuges are used in the third as an alternative method. Each hopper is suspended from a scale arm and so arranged that if the screenings reach it more rapidly than its filter can take them, the increasing weight in the hopper causes it to reduce the amount reaching it from the conveyor, the surplus passing on to the next hopper. The liquid from these filters drains back to the sewage above the fine screens.

The dewatered solids from these filters can be burned in the incinerator with the aid of a little gas or oil as fuel; but to facilitate combustion and the operation of the incinerator, they are either passed through rollers, similar to those used in paper mills; or are pushed through a tube of conical shape with a flat angle, in which revolves a screw conveyor which fits it rather loosely from end to end, the screenings being fed in at the large end and emerging at the small end, which subjects them to combined pressure and rending and squeezes out additional moisture, which is drained back to the unscreened sewage. These solids now contain about 60% moisture and are readily self-burning and can accumulate for several days without putrefying, so that the operation of the incinerator can be made more nearly uniform throughout the day and night, and for successive days.

After each of the three units of the plant has operated for a few days, sewage is diverted from it, the outlet is closed, the sewage in the unit lowered two or three feet by pumping (removing this small amount of sewage is the only pumping required in connection with the plant), and the attendant enters the several housings and thoroughly cleans all the apparatus with hot water and steam furnished by the incinerator.

The incinerator might, we suggested, be used to furnish power for operating the plant (for which current from the municipal power plant is used), but Mr. Nemo said that, while this might be possible, experience with refuse incinerators discouraged them from attempting it.

This sounds like a lot of machinery, but really the amount of power required is remarkably small. All screens and conveyors run on roller bearings, none of which are under water. There is less than two feet loss of head through the entire plant, therefore no lifting of water is required except less than 1% raised three feet to dewater for cleaning; and the power required to convey the screenings to the filters and the top of the incinerator by ejector and conveyor would hardly run a Ford car.

The plant was of course an expensive one to build; but it is located in the city, thus eliminating the cost of a mile or two of outfall sewer; and as it requires no head, there is no cost for installing and operating a pumping plant, which is necessary in many cities. As for land cost, all the equipment except incinerator and filters are below ground level, and the rental of the floors above covers overhead on this.

Operation is not expensive. The coagulant used is cheap; in fact, part of it is pulp made from newspapers collected as rubbish. Two operators, one day and one night, easily run it; hosing off one set of screens and conveyors once a day, keeping the grease cups filled, and stoking the incinerator are the principal duties. An occasional truck is used for removing the grit and incinerator cinders, each of which is discharged by conveyor into an elevated hopper which discharges into the truck; but these are worth considerably more than the cost of the trucking.

Many very interesting details might be described if space permitted; such as the use of photo-electric cells to regulate the dosing of the sewage by which the pH is maintained at the optimum for coagulation; and the automatically reversing and self-cleaning screen in the effluent which, should the effluent at any time contain more suspended matter than is permissible, diverts it into a supplementary filter.

A few days ago the editor had a vision of the sewage plant of tomorrow which not only may interest sanitary engineers but may also suggest directions in which investigation and invention may be directed to advantage. The above is a description of this vision.

He believes that no features of this are impossible or improbable. In fact, he expects to see practically all of them embodied in operating plants within the next ten—possibly five—years. Some are already in use in a few plants.

If any reader of this vision has one of his own which differs from this one or supplements it, we hope he will send it to us. Progressive engineering is largely applied imagination, and a compendium of these ideas may point the direction to intensely practical results by which all sanitary engineers may benefit.

Reflector Signs Adopted for California Highways

THE Division of Highways of California will this year install reflectorized directional signs at several important road intersections, the service to be extended gradually. The signs will be installed either at the side of the road in advance of the intersection, or at its gore, depending upon the grade of approach and angle of divergence between the two roads. Only two names with directional arrows will be shown on the signs, one for each road.

These signs will be mounted high enough to clear intervening machines, and on the darkest night will be seen by motorists some 500 to 700 feet away, as they should be when automobile speeds are as high as they are today.

To aid the division in designing these signs, C. F. Woodin, assistant maintenance engineer, in March 1931, carried on a thorough investigation of various types of reflector units to determine the effect of color, size and spacing, distance and angularity; also design the best letters, as those ordinarily used for signs are not suited for use in a reflector-type sign to be read beyond 300 feet. Certain conclusions were reached tentatively, subject to modification after being tried in practice, and used in making the signs first installed. These conclusions are as follows:

1. Of the four sizes of reflectors tested, the 1-inch size gives the best results, with the 7/8 size very satisfactory. The 5/8-inch and 1 1/8-inch sizes are not adaptable to directional signs.
2. For best results, reflectors should be placed at the minimum spacing.
3. Crystal reflectors reflect light with greater intensity than yellow reflectors.
4. Single lines of reflectors in letters are better than double lines because of the greater separation afforded the line of reflectors. For good legibility it is important that the contrast between the reflectors and the background be sharp and clear. Parallel strokes in a given letter should be separated as far as possible within reasonable limits to provide this contrast.
5. A 12-inch letter of proper proportions is visible at about 700 feet distance and easily readable at 500 feet. An 18-inch letter of the same proportions is visible at about 800 feet and can be read at 650 feet.
6. Certain types of reflectors have sufficient intensity when 10 feet above the ground as to render a letter legible for as great a distance as when the reflector is located at headlight height, provided the atmospheric conditions are favorable.
7. The spacing between letters for the 12-inch height should be about 2 1/2 inches; and for the 18-inch letters, should be increased to 3 or 3 1/2 inches. Of course adjacent letters shaped to increase the size of the intervening space may have a smaller minimum interval as prompted by the rules of sign composition.
8. The height at which the sign should be placed will be governed by the conditions encountered. Grade, alignment, roadside development and obstructions will all be influencing factors. Sufficient height that the driver of each car may read above another car traveling ahead, is a distinct advantage. Obviously the closer the reflectors are to the direct beams of the headlight, the greater the intensity of the reflection. In the event of unfavorable atmospheric conditions, the reflector of the greatest intensity will give the best service. Signs should therefore be placed as low as possible to give the best visibility. Heights up to 10 feet have been found satisfactory. Before any installation is made, trial reflector letters should be set up in several locations to determine the best location under the conditions encountered.
9. The failure of existing directional signs is due to several causes, namely:

(a) The signs are constructed on enameled metal of high gloss and almost as reflective as the reflector. A dead, non-reflecting background is most desirable.

(b) The letters are too small for legibility at any distance beyond 300 feet.

(c) The letters are too slender, that is, the width is too narrow for the height.

(d) The letters should be white on a black background. In the daytime reflectors appear white. With black letters on a white background, the reflectors reduce the amount of black to such an extent as to render the letters almost invisible except at very short distances.

It is not intended to use reflector signs exclusive of electrically illuminated signs; under certain conditions of alignment, density of traffic or roadside lighting the reflector type would not be effective.

Concerning the design of the letters, it is believed that letters such as "W," "A," "M," etc., should be

Above—Night and day view of caution sign.
Bottom—Direction sign

wider than those commonly used. A square effect given the letter "O" makes it difficult to differentiate it from a "D," and both should be more rounded. Likewise, "S," "C," "G," should be curved, with longer radii than has heretofore been the practice. For letters 12″ high the lines are made 1¾″ wide.

Standard letters recommended

The curves in B, C, etc., are given 1½″ interior radius; D a 2″ radius at top and bottom; U a 2½″ radius. A and T are 10″ in extreme width; M and W are 12″; L is 7½″; but most of the others are 8½″. Direction arrows are placed above and below the names, not in line with them.

Garbage Incineration at Racine

Racine, Wis., with a population of about 68,000, incinerated 10,786 tons of garbage in 1931 and 9,553 tons in 1930, using a Pittsburgh-Des Moines incinerator both years. The city has incinerated its garbage since 1913, when a Lewis & Kitchen incinerator was installed. The Pittsburgh-Des Moines plant, which cost $98,800, was given its acceptance test on January 15th, 1930. In order to reduce hauling cost, the plant was located centrally, only about 250 feet from the site of the new city hall.

No rubbish is burned with the garbage and coal is used as fuel; 65.5 tons was used in 1931, or 149 pounds per ton of garbage. "In the old days," writes M. C. Gearen, superintendent of incinerator, "packing was done in barrels and boxes, and the wood had heat units and would burn for some time; but now everything is packed in paper cartons, and these, loose paper, excelsior, etc., burn up rapidy."

The garbage is collected in highway trailers drawn by horses, which are then pulled to the incinerator by tractor truck. Six 1½ ton collection vehicles are used in summer and five in winter. Some of the garbage burned is brought in by outsiders in trucks and horse-drawn wagons. In the winter time a great many people burn their garbage and the collections may be 50% less than in summer. The collection vehicles can carry 3000 pounds, and many do in summer; but the same routes in winter yield from 1200 to 2000 pounds. During 1931 the amounts incinerated per month varied from 560 tons in January to 1351 in September. Cost of collection averaged $3.30 per load.

The amount of coal used varied considerably more than did the amount of garbage—from 62,100 pounds in January to 248,800 in September, chiefly if not wholly because the excess summer garbage contained more moisture. The amount per ton varied from 106 pounds in February to 184 in September; there being 19 days of the latter month when the garbage was unusually wet, but only 8 days of the former.

The incinerator has a nominal capacity of 120 tons, and the three units averaged only 40.3 hours of burning in January and 209.7 hours in September. As the incinerator was operated 25 days in the latter month, that gives an average of 8.39 hours per day in the maximum month. In January one unit was operated an average of about 3 hours per day on the average and the other two about half as long.

The costs at the incinerator plant in 1931 comprised an average of three men at $5 a day, coal at $5.50 a ton, power at 4 cts per kwh. and water at $1.00 a day. "The cost for repairs on the plant was less than $50 for the first two years of operation and the grates today are just like new," says Mr. Gearen.

The details of cost of operation of the plant in 1930 (1931 figures were not available at this writing) were as follows:

Salaries and wages	$5,200.50
Telephone and telegraph	78.50
Rent	150.00
Fuel	3,401.29
Light, power and water	727.51
Repairs and replacements:	
Building repairs	20.69
Heating repairs	29.40
Small tools equipment	165.60
Total	$9,773.49

The itemized costs of garbage collection were as follows:

Salary of department head	$2,353.65
Salaries and wages	20,249.41
Feed and water	2,491.45
Auto repair and tires	492.89
Gas, oil and licenses	708.03
Light and power	28.29
Repairs and replacements	
Barn repairs	22.23
Harness repair	210.40
Horse shoeing	475.74
Small tools equipment	50.21
Veterinary	10.50
Total	$27,092.80

The cost of disposal per ton was $1.02 in 1930 and $1.05 in 1931. The cost of collection was $3.45 per load in 1930 and $3.30 in 1931. Prior to 1930 the cost had run about $3.00 a load, but the loads were smaller, and the cost per ton was really greater than in 1930 and 1931. The cost per ton in 1930 was $2.83, or nearly three times as much as the cost of incineration.

It will be noticed that if only 10% be allowed for interest and depreciation on the incineration plant, this equals the total of the operating costs.

Following is the report, by months, of the operation of the incinerator during 1931.

Operation of Disposal Plant in 1931	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	All
Tons destroyed	599.90	583.30	653.25	729.80	761.35	1,009.30	1,111.20	1,222.95	1,351.00	1,026.80	897.45	879.95	10,786
Pounds coal used	62,100	62,200	80,800	98,300	104,300	146,400	174,800	186,500	248,800	207,600	143,700	131,000	1,646,500
K.W.H. current used	280	200	210	270	330	560	680	910	1790	910	490	240	6,870
Total furnace-hours	121	151	188	215	252	445	490	558	629	529	394	289	4,261
Tons per hour	4.62	3.86	3.47	3.39	3.02	2.27	2.27	2.19	2.15	1.94	2.28	3.04	2.53
Pounds coal per ton	110	106	123	134	136	145	157	152	184	202	160	148	153
K.W.H. current per ton	0.50	0.34	0.32	0.37	0.43	0.56	0.61	0.74	1.3	0.89	0.52	0.27	0.64
Days burning	23	21	22	22	24	26	26	26	25	27	21	23	286
Number of days when garbarge was unusually wet	2	8	12	6	9	10	3	6	19	6	7	5	93

Modern Earth-Handling Machinery Lowers Road Grading Costs

By P. M. Tebbs

Assistant Chief Engineer, Pennsylvania Dept. of Highways.

IN presenting this subject, the writer has confined his studies and analyses to experiences and results in Pennsylvania, but believes that these experiences will find close parallels in all of the states in the northeastern part of the country. The prices used cover the period from 1921 to 1931, since prices prior to that decade were too greatly affected by war conditions.

The highway constructor measures the value of labor-saving machinery and methods by the greater volume of work performed with the same organization and equipment and the proportionate decrease in operation and overhead costs. These appeal to the highway engineer also if the reduced costs are reflected in the prices bid, and the quality of the product is maintained.

In order to consider this subject from all angles, the equipment, methods and cost of handling excavation, subgrade, forms and shoulders are included in the scope of these studies, as they vitally affect the completed construction and the final cost; while drainage, culvert and bridge construction, being factors which vary in different projects, are excluded.

1. Excavation

By 1921, the ½ cu. yd. to ¾ cu. yd. steam shovel had become the standard equipment for rough grading in Pennsylvania (although for a few years following, certain contractors continued to use tractors, plows, scoops and road machines for comparatively light grading), and wagons were used almost entirely to haul the excavated material to the embankment, where it was spread with hand shovels or light road machines and rolled with 10-ton steam rollers.

Development, however, was very rapid. The steam shovel was superseded by the 1 to 1½ cu. yd. gas, gas-air or gas-electric equipment, and team and wagon hauling by trucks with solid tires and later with pneumatics, or by tractor haulage of large wagons with "three-way" dumping facilities. Spreading of the excavated material developed larger road machines, tractor hauled, which were succeeded by the "Bull Dozers," now almost universally used, which for ordinary grading require no labor except a foreman to direct where the material is to be dumped. The steam roller has been succeeded by the faster and stronger gasoline roller, which can operate a full day with a minimum of attention while the steam roller during a large part of the day was securing water, or its operator was either building or drawing a fire, or making some adjustments to the machine.

In the year 1921 if a shovel averaged 200 cubic yards per day of material removed and placed properly in the embankment, it was considered a good day's work. Today, if the production is not many times that figure, a detailed investigation is made by the contractor. This is reflected in the bids received for grading. (See table at foot of page.)

In 1924, the first year in which Pennsylvania paid a separate unit price for subgrade and shoulders, the total cost per mile additional for these items amounted to $2724.48 which, divided by 5848 cubic yards gives an increase of $0.466 per cubic yard, making the total unit price of excavation that year $1.843, an exceptionally high figure. A slight reduction was apparent in 1925, but not until 1926 did the unit price, including subgrade and shoulders indicate that the contractors made due allowance for the change in specifications.

The decrease of more than 30 per cent in the unit price of 1931 as compared with 1930 is attributed to the comparatively small program in Pennsylvania for that year with the resultant keen competition, and the fall in prices due to the depression. Wages decreased approximately 20 to 25 per cent, so we may assume the additional reduction may be credited to equipment and more efficient operation or to reduced profits.

The reduction of grading quantities per mile in 1931 was due to improving roads of lesser importance where refinements of alignment and grade were not as necessary as on the construction of our more important highways. This reduction in quantities apparently did not effect reduction in unit costs.

2. Subgrade

In the early days of highway construction subgrading was performed by teams, plows and hand

Summary of Grading Costs for Years 1921 to 1931, Inclusive

Year	Excavation per cubic yard Class 1	Class 2	Borrow	Clearing-Grubbing Per Mile	Subgrade per Sq. Yd.	Shoulders per Lin. Ft.	Average Number Cubic Yards Per Mile*	Average Cost per Mile
1921	$1.805		$1.805				5,820	$10,500.00
1922	1.192		1.192				5,890	7,020.00
1923	1.433		1.571				4,523	6,900.36
1924	1.377		1.304		.154	.208	5,848	10,599.00
1925	1.166		1.026		.160	.198	7,445	10,959.67
1926	.883	1.345	.881		.141	.179	9,459	10,355.62
1927	.941	1.526	.858		.135	.178	9,408	11,051.96
1928	.792	1.608	.790	$319.30	.130	.172	12,595	12,486.15
1929	.810	1.670	.766	460.14	.139	.196	16,432	16,470.66
1930	.775	1.777	.731	577.75	.143	.195	19,412	18,579.85
1931	.535	1.340	.483	299.05	.109	.167	9,462	7,603.98

* Includes Class 1 and Class 2 excavation and borrow in all cases.

labor. The roller equipped with scarifier and the road machine succeeded them, followed by subgrading machines pulled by the roller, and "one man" power graders. This resulted not so much in reduction of the actual number of men employed in the operation as in the vast increase in amount of subgrade which could be prepared in a given time, and consequently in the rate of pavement production; but it was not for several years afterwards that contractors were capable to keep the subgrade sufficiently in advance of their paving to insure continuous operation of the paving equipment. There is still considerable room for improvement.

The unit prices for this class of work from the years 1924 to 1931 inclusive are as follows:

Summary of Subgrade Costs for the Years 1924 to 1931

Year	*Bid Price Per Square Yard*	*Approximate Cost per Mile of 18 Foot Road*
1924	$0.154	$1,626.24
1925	0.160	1,689.60
1926	0.141	1,488.96
1927	0.135	1,425.60
1928	0.130	1,372.80
1929	0.139	1,467.84
1930	0.143	1,510.08
1931	0.109	1,151.04

These prices show no saving to the State due to improved equipment and methods. (The saving of 25 per cent in 1931 was due to existing economic conditions.) This lack of saving, in all fairness to the construction industry, may be attributed to higher standards of specification requirements and stricter adherence to them. A considerable number of changes in form sizes and designs accounts for the higher prices of the years 1924 and 1925.

3. Forms

Although this item is a part of the subgrade operation and costs, it is so important from a labor saving standpoint that it is treated separately. The early forms were designed with no thought to resist the impact of the pavement fabricating operations, but the advent of finishing machines brought out the necessity for stronger forms to insure smoother riding pavements, and studies conducted by the Federal Government in 1929 showed that not only riding qualities but also thickness of concrete were affected by the settlement of the forms. This knowledge resulted in stricter specification requirements, such as greater weight of material, more rigid connections, larger and stronger pins, and a minimum base width of six inches. (In the future, Pennsylvania will require an 8-inch base.) This stronger form resulted in a large saving in labor by elminating the checking and resetting necessary with the lighter forms.

The use of form grader equipment has proved economical and efficient in many cases and results in considerable saving in cost.

The forms specified and the equipment and methods used to set them have resulted in a marked increase in the quality of the finished product, even if there has been no apparent saving in actual cost of the work.

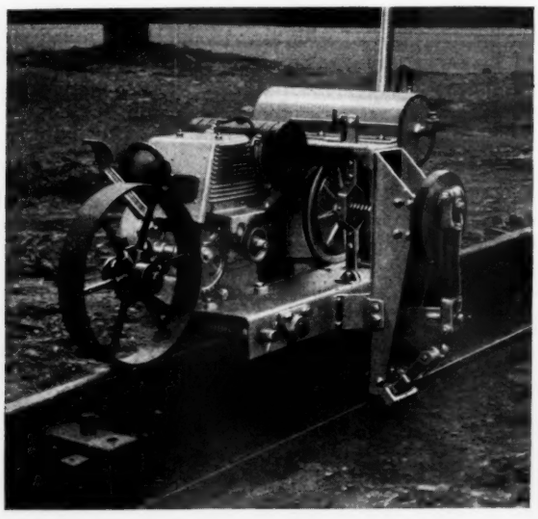
4. Shoulders

Improved models of road machines with back slopers and one-man power graders with pneumatic tires have been the principal developments in labor saving machinery on shoulder construction. Progress and quality of work have been improved considerably, but, as shown by the following tabulation, there has been no appreciable reduction from 1924 to 1930 inclusive. Reduced costs in 1931 are attributed to existing economic conditions:

Summary of Costs of Shoulders for the Years 1924 to 1931

Year	*Bid Price Per Lineal Foot*	*Approximate Cost Per Mile of Road*
1924	$0.208	$1,098.24
1925	0.198	1,045.44
1926	0.179	945.12
1927	0.178	939.84
1928	0.172	908.16
1929	0.196	1,034.88
1930	0.195	1,030.60
1931	0.167	881.76

The above is part of a paper (slightly condensed) read before the Ass'n of Highway Officials of the Northeastern States by P. M. Tibbs, assistant chief engineer of the Pennsylvania Department of Highways, based upon studies made by C. H. Buckius, construction engineer of the department. The remainder of the article, dealing with construction of concrete pavement, will appear in the next issue.



Form tamper prevents settlement of form during pavement construction

The Road Adjuster gives uniform subgrades and roads

Fredericksburg, Virginia, Collects Garbage Economically by the Can System

By L. J. Houston, Jr., City Manager

AFTER building a modern filtration plant to provide pure, wholesome water, supplying sanitary sewers to more than 99 per cent of its buildings, and paving more than 95% of its streets with inexpensive, though highly effective, asphalt paving, Fredericksburg, Virginia, a city of about 7,000 population, undertook to solve the problem of its troublesome twins, the collection and disposal of the garbage and trash The criterion it adopted for such a service was that it must be designed primarily for the health and happiness of the householder rather than for the convenience of the department performing the service. That we have successfully met this specification is evidenced by the universal commendation received from our citizens, which of course is most gratifying.

After a most careful study of the various methods of disposal we unhesitatingly decided on incineration. Accordingly, following further study and inspections, we built a modern incinerator, in which we burn all garbage and trash, including leaves. In this incinerator we placed coils so as to utilize the heat therefrom to heat water for can washing.

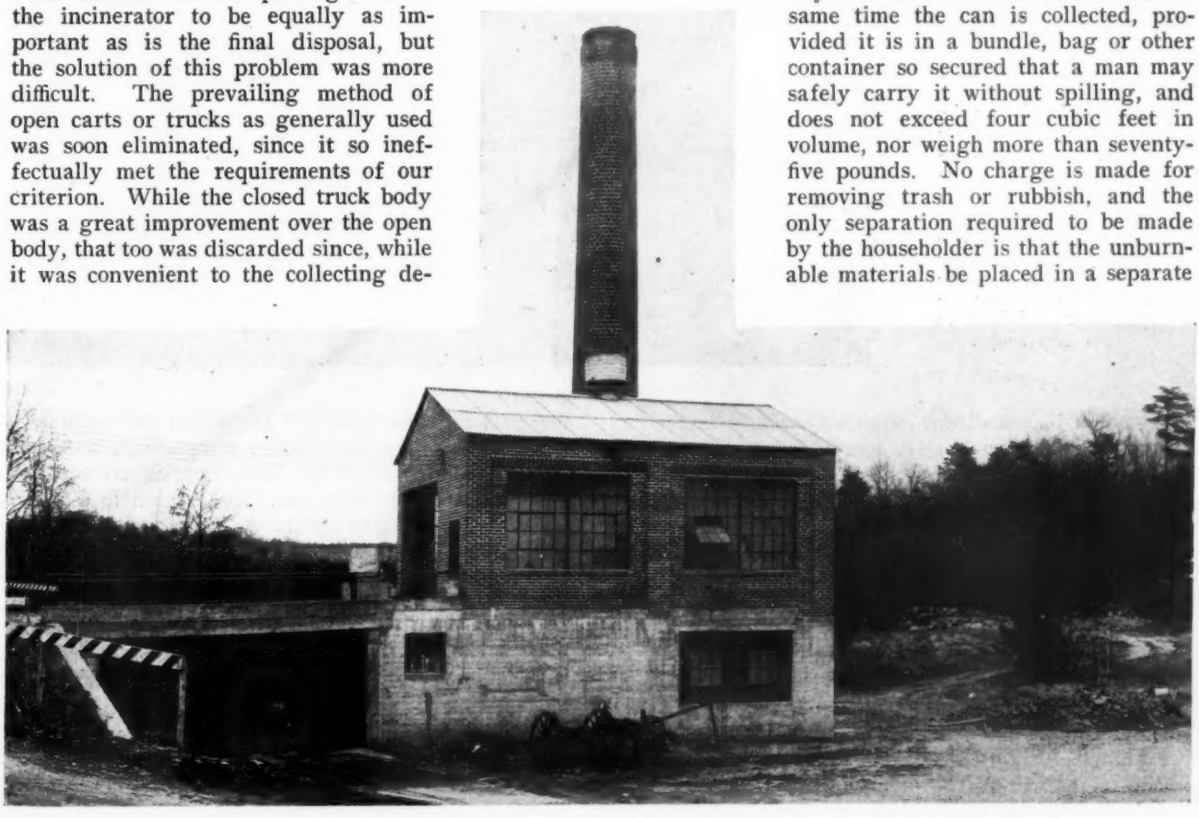
Collecting Methods

We consider the manner and method of collecting these wastes and transporting them to the incinerator to be equally as important as is the final disposal, but the solution of this problem was more difficult. The prevailing method of open carts or trucks as generally used was soon eliminated, since it so ineffectually met the requirements of our criterion. While the closed truck body was a great improvement over the open body, that too was discarded since, while it was convenient to the collecting department, it gave the householder no greater relief than did the open body truck.

This of necessity brought us to the so-called can system. While we found several such systems in operation, we failed to find a single instance where the service was complete. In some instances cans were furnished by the city and in others by the householder; but in virtually every city where the can system was used only garbage was collected, and in most of these cases only hog-feeding garbage was permitted in the cans. Trash, including tin cans, glass and other refuse, was collected at infrequent intervals.

Finding no city whose system met our requirements, we decided to take the best features of several, and to improve and modify them to suit our needs. In order to simplify and facilitate handling it was decided that the city would furnish the cans, one can being furnished free to each family, store, restaurant, etc. Additional cans are furnished and serviced at a charge of ten cents per can per collection. It has been found that one can is ample in each case, except for boarding houses, hotels and restaurants. We permit anything to go in the can that is burnable, construing tin cans to be burnable.

In addition to what is placed in the can, we collect any and all rubbish and trash at the same time the can is collected, provided it is in a bundle, bag or other container so secured that a man may safely carry it without spilling, and does not exceed four cubic feet in volume, nor weigh more than seventy-five pounds. No charge is made for removing trash or rubbish, and the only separation required to be made by the householder is that the unburnable materials be placed in a separate



Fredericksburg, Va., incinerator building. Furnaces are charged and cans washed on upper floor.

container from the burnable. Garbage liquor is disposed of through the sink into the sanitary sewer.

The cans we use are galvanized, with smooth sides, fourteen inches in diameter and eighteen inches high, having a capacity of twelve gallons, and fitted with a tight cover. They are specially made, having the word "City" stamped by special die in the bottom of the can as well as in the cover. The cans are simply loaned to the householders, who are held responsible for the safety of them. The city also furnishes specially designed burlap bags, also free, for the convenience of the householder for leaves, paper and other light trash. The full bag is removed and another empty bag left. The use of bags by the householders avoids the burning of leaves or raking them out on the street, both of which practices are now prohibited by ordinance. When moving from one address to another, the family leaves the can and bag behind, as others will be awaiting them at the new location.

For collection we use two trucks of 1½-tons capacity each, with bodies of our own design, built in the city shop. These bodies are six feet wide and sixteen feet long. The front portion is provided with two decks on which sixty-six cans are carried, and an upper deck for carrying a spare tire, rain clothes for the collectors, spare cans and excess trash. The decks are so arranged that, while the cans may be readily loaded or removed, they cannot slide out or tip over, thus assuring their safety while the truck is in motion. The rear portion is a box of 150 cubic feet capacity for trash. This box is open at the top and is provided with three doors at the rear for unloading at the incinerator.

Above—Loading rubbish box of collecting truck. At right—Unloading truck at incinerator. This truck, which carries sixty-six garbage cans and 150 cubic feet of inflammable rubbish, was designed by the city department and built in the city shops.

The city was divided into twenty-eight routes, and route maps were made of each route. On these maps not only was the exact route of the truck shown, but the location of each can as well. A set of these route maps is always with the truck driver, who is held responsible for the collection of his routes. The trucks start out in the morning with a load of clean cans. Two collectors go with each truck, but only one collector is needed to service a place. He carries the clean empty can and bag into the property, collections being from the back door or back yard, and brings out the full can and excess trash, if any. When the end of the route has been reached, the loaded truck, with the collectors, proceeds to the incinerator, which is located on the city farm, about a mile from the city.

Arriving at the incinerator, the driver and his two collectors unload the truck and reload it with a fresh load of empty clean cans, which are waiting. It requires about an hour for a truck to make a round trip and they are so timed that they will not interfere with each other at the incinerator. One truck starts at seven and the other at seven-thirty in the morning and each crew is able easily to complete its seven trips and wash off its trucks within the allotted day's work.

Work at the Incinerator

Two men are employed at the incinerator. One dumps the contents of the garbage cans and the bags into the incinerator and attends to the other duties of operating the plant. The other man spends his time washing the cans and stacking them for later use. In addition to the trash and rubbish brought by the collecting trucks, the incinerator receives a quantity of trash and rubbish from large stores, factories and private haulers, all of which materials are received without restriction, except that unburnable matter must be kept separate.

The incinerator, built by the Pittsburgh-Des Moines Steel Co., is rated to burn three tons in 24 hours and has proved of ample capacity for this city of 7,000 population.

Cost of Rendering Service

We are collecting about 900 cans per day, and are covering the entire city three times each week during seven months of the year, and twice a week during the

remaining five months. Our labor cost is $90 per week for three collections per week and $60 for two collections per week. During the two collections period only one truck, with driver and three collectors, is required. Operating the incinerator and washing cans cost $38 per week, making a total labor cost of $128 per week for handling our troublesome twins during the summer and $98 during the winter months.

Our total annual labor cost for collecting is $0.59 per capita of population, and for incineration and can washing it is $0.29, making a total of $0.88 per capita per year. Adding the other necessary costs, our total for collections is $0.75, and for incineration and can washing $0.34, or a total cost of $1.09 per capita per year. We could have reduced this cost some by requiring our citizens to place the wastes on the curb and return the empties. Our citizens, however, feel that the added cost is money well spent for the excellent service they are receiving.

Costs in Other Virginia Municipalities

Comparing the per capita per year costs of some of the other municipalities of the state, large, medium and small, which, as far as I could determine, were giving more or less complete service, I find that they vary widely. In those places which used dumps entirely, the costs ranged from $.63 to $1.09; in those using hog-feeding for the garbage and dumps for the balance, the costs were from $0.53 to $0.95; in those hog-feeding the garbage and incinerating the trash, they were $1.22 to $1.64; and in those incinerating the garbage and trash, the costs were from $0.66 to $1.43. While I have assumed in all these cases the entire collecting was done by the city or town, it is likely that in some of the places, especially where hog-feeding is used, a considerable part of the garbage is collected by individuals. In none of the 72 cities and towns of the state was the so-called can system of collection used except in Fredericksburg, notwithstanding the fact that the per capita cost of this system compares favorably with the less sanitary and more unsatisfactory methods generally prevailing.

Washing and steaming cans, ready for redistribution

Can System Adaptable to Both Large and Small Cities

I have devoted considerable time to investigating the various systems of collecting and disposing of garbage and trash in every state of the United States, as well as in England and Germany. This study convinced me that the methods generally prevailing were not adequate, and that improved methods could be used without making the cost excessive. The past eighteen months of actual operation of the can system of collection even more strongly convinces me that, with proper arrangement of route districts for collection and the use of smaller incinerators in the larger cities, the can system may be operated in the large cities as well as in the smaller ones.

I am equally convinced that smaller incinerators, placed at convenient locations throughout the city, will materially reduce the cost of collection and will improve the conditions in and around the incinerator. In my investigation I found several of the larger incinerators giving trouble, one practically new one to the extent of being a public nuisance. In the smaller ones, however, the conditions were so satisfactory that, so far as any odors from the plant were concerned, there could not be the slightest objection to locating them in either business or residential neighborhoods.

And, so far as the can system of collection is concerned, where all of the garbage and trash is removed from the back door; where there is furnished a clean, steamed-out can three times a week, in which may be placed all burnable household waste, including tin cans, and where all of this is hauled in trucks of attractive appearance and free from all offensive odors, I can assure you that our citizens in Fredericksburg are justly proud of it and would not now be satisfied with anything less. While it was somewhat of an unusual venture for us, I am glad to say that our City Council voted 100% in favor of it and our citizens have cooperated beautifully in our efforts to maintain what we believe to be the most satisfactory garbage and trash collecting system in the entire United States, and, if need be, the limits can be extended to foreign countries.

The above is a paper, slightly abbreviated, presented by Mr. Houston before the League of Virginia Municipalities. In connection with this description, he gave the results of his investigation of the collection and disposal methods employed by 72 Virginia cities and towns, which we expect to publish as a separate article.

City Liable for Damages Caused by Sewage Disposal

The city of Barnesville, Ga., emptied its sewage into a stream which flowed through the land of one Parham, who brought action against the city to recover damages. The city carried the case to the court of appeals, which ruled that a landowner may recover damages for the impaired rental value of his land and tenant houses thereon, resulting from a continuing nuisance caused by the emptying by a municipality of obnoxious and deleterious sewage into a stream which flows through the land, and also for damage to him while living in a dwelling house on the land, resulting from the contaminated atmosphere, poisonous gases, offensive odors and vapors caused by this contamination of the stream.

New Method of Backfilling Trenches and Service Cuts

By Bernard E. Gray
Highway Engineer, The Asphalt Institute

FOR a long time a bituminous mixture has been sought which would have complete cementing and waterproof qualities and yet be of sufficient flexibility to permit easy handling and manipulation. A number of bitumens have been tried, but although some would have high cementing value they would harden too quickly and lose their flexibility, while others having complete flexibility would never harden enough to develop complete stability. A bitumen having both qualities is now available, known as Asphalt Institute Material No. 4, and is defined under the following specification:

Specific viscosity (Engler) 50 cc., at 122°F....	**50 to 80**
Distillation, per cent by volume	
Total distillate to 437°F., not more than..	5
Distillate between 600°F., and 680°F., not more than	12
Tests on residue from distillation	
Penetration 77°F., 100 g., 5 sec.	**100 to 350**
Ductility 77°F., not less than.....	60
Per cent soluble in carbon disulphide, not less than	99.0

Such a material has a wide application, principally in road-mix or plant-mix surfacing which may be consolidated and finished under traffic by blading. In addition, however, there are a number of special conditions for which the material is particularly useful, such as surfacing service cuts in road and street pavements. The conventional method of handling such work (except in large cities) is to backfill the trench with earth and then to allow a period of time for settlement before replacing the wearing course. That this condition makes for enormous inconvenience to traffic, as well as being a source of considerable danger, is well known. Furthermore, unless the new foundation is extended for a considerable width beyond the trench on either side, additional settlement is certain to occur, thereby necessitating further repairs even months afterward.

By using the slow-curing asphalt cutback No. 4 much of this trouble can be eliminated. Mixed with a continuously graded aggregate, a mixture may be made which can be stock-piled indefinitely and yet which will handle and spread almost as easily as untreated sand or gravel. It compacts quickly under traffic, and yet bonds readily with new layers placed upon it, so that during the period of backfill settlement, an unyielding foundation is built up which is superior in supporting qualities to those constructed by the old conventional methods and yet is lower in cost.

The material is prepared by mixing from twenty to thirty gallons per cubic yard of graded aggregate (loose measure). The aggregate should be dry, but does not require heating nor is it necessary to heat the asphalt. The mixing may be done by hand, in a concrete mixer or in any type of asphalt plant. A complete intimate mixture is rapidly obtained, and either additional aggregate or additional asphalt may be added later if required to obtain a proper consistency. The quantities of asphalt given above are based on voids in the aggregate ranging from twenty to twenty-five per cent, which would include most sandy gravels or similar graded material. Complete formulas and tables for determining proper mixtures for all aggregates are to be found in Manual No. 1 (revised) on Road-Mix Types, published by The Asphalt Institute, and available free upon request. For most aggregates, the proper amount of asphaltic material required may be quite closely determined (within the above range) by inspection of the behavior of the mixture under traffic. A proper mixture will be sufficiently dry, so that when taken up in a handful and squeezed together, it will not stain the fingers, and yet will stick together like moist sand. In a pile, loose, it will have a live crawly appearance, and under pneumatic-tired traffic will quickly compact together and present a well knit surface.

The various steps are shown by Figures I to IV with appropriate notations.

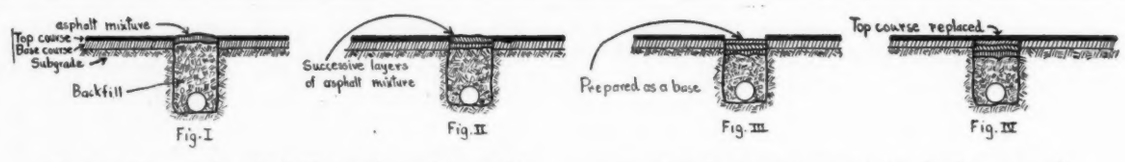


Fig. I—The trench is backfilled with earth to within two or three inches of the top, and the balance is filled with asphalt mixture.

Fig. II—As the trench settles another inch or two, additional asphalt mixture is placed to maintain surface smoothness, and readily bonds with previously placed material. This process is continued as further settlement takes place.

Fig. III—After settlement stops, the surfacing is removed to bottom of adjacent wearing course, an easily accomplished step because of the flexible yet stable character of the mixture. The asphalt mixture removed should be salvaged, as it can be remixed and used again.

Fig. IV—A top course surfacing to match the adjacent pavement is placed, using the asphalt mixture as a base course. Because of its compaction under traffic and intimate contact not only with the subgrade but with the sides of the trench, a thoroughly durable and consolidated foundation is obtained by this process.

THE EDITOR'S PAGE

Are You Out of Work?

Many engineers are finding more spare time on their hands these days than they wish, having lost their jobs or finding no work coming into their offices, and naturally this annoys and worries them. They of course are employing all possible means of remedying this condition; but meantime some we know are overlooking the opportunity this enforced leisure offers them of adding to their knowledge and ability to handle work when it is obtained.

How often in busy times did we hear engineers say: "I wish I had time to study up these new ideas that are coming into practice." Well, now many of them have it; are they taking advantage of it? Are they reading the technical papers and proceedings that they for months have been laying aside for just that purpose? Are they visiting all water or sewage plants, incinerators, road jobs, or whatever their specialty may be, within easy automobile distance? Are they writing up some of the interesting work they have done, to secure legitimate publicity through technical societies or periodicals? Are they trying to put into practical, patentable form that apparatus or method that has occupied the background of their minds for so many months? Are they, in short, preparing for the future rather than uselessly worrying about the present?

A concrete example often is more convincing than a page of platitudes, and the editor, at the risk of seeming egotistic, will cite one from his own experience. In 1895 also there was a depression, and he found his engineering practice approaching the vanishing point. He was specializing in sewerage and water supply, but could find no satisfactory book on the former, so took this opportunity to read up everything he could find on the subject in engineering papers, the library of the A. S. C. E., engineers' reports and information furnished by correspondence. Ultimately he accumulated so much material that he decided to embody it in a book. If it had not been for that depression he probobaly never would have written "Sewerage," and his authorship of this was to prove an asset to him more valuable than anything else he has accomplished with an equal expenditure of time.

Mechanizing Old Sewage Plants

Sewage treatment plants a few years ago were generally thought of as disgusting places—and most of them were. They were, as far as possible, put out of sight and smell, and out of mind, and what little attention was given to them was performed by the cheapest of labor. It had to be, for what other kind would shovel sludge by hand off of sand beds and out of tanks, perform the back-breaking cleaning of bar screens, and spend their days amid the odors and flies which hovered around such plants?

With maintenance of the plant rendered less arduous and filthy by use of sludge pipes hydrostatically operated, mechanical tank cleaners and screen cleaners and similar equipment, has come an infinitely higher grade of supervisors of plants, and of plant condition and performance. We doubt if it is possible even today, when appreciation of sewage treatment possibilities and requirements has become general, to get satisfactory results from the old type of plant or competent men to operate them.

Many communities, both large and small, are still laboring with plants at least fifteen years old, which should be brought up to date with mechanical equipment, but find it impossible to raise the money now for a complete new plant. However, it is possible to either build a new plant or rebuild an old one by stages if there is intelligent planning. It is desirable to construct at least two, and preferably three or more, units of each feature of a plant to provide for varying amounts of sewage and "stand-by" equipment. One unit of each feature, or of only one or two features, can be built at present to treat, wholly or partly, part of the sewage only. This is better than no treatment, and is a step toward a complete plant.

This idea is especially applicable to modernizing an old plant. An existing manually cleaned bar screen may easily be equipped with a mechanical cleaning device; a battery of grit chambers may be changed over to a mechanically cleaned detritus tank; plain sedimentation tanks may be modernized with mechanical sludge removers; old, open digestion tanks can be converted to the closed, heated type with mechanical sludge handling and equipment for gas collection and utilization; overworked sludge drying beds can be doubled in capacity by covering with glass enclosures; or can be replaced with vacuum filters, the product of which can be used as fertilizer or burned in an incinerator and the sludge problem be solved permanently. Any one of these changes will be advantageous whether or not the others be made; and step by step the entire plant can be transformed into a completely modern one. But the entire change should be planned at the outset so that the several parts will be of uniform capacity and properly supplement each other.

Sanitary Engineering Services to States

At the recent meeting of the American Water Works Association held in Memphis, Tenn., an unofficial meeting of the State Sanitary Engineers passed resolutions of appreciation for the valuable services rendered by the Public Health Service through H. E. Miller. Mr. Miller has been acting as coordinator between the Public Health Service and the various state engineering departments during the past year. His wide experience and his thorough knowledge of state sanitary and public health engineering have been a real help in solving many problems in this field during the past year. The Public Health Service is to be congratulated on this advanced and successful step, which we hope will be continued in the future.

Public Works Construction for Prosperity

By Major John F. Druar
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ECONOMISTS and theorists to the contrary, there is to my mind only one way out of our present difficulties as a nation—for the Federal government to devote every effort in cooperation with small-town officials to help such towns to prosperity. History has shown that when the rural communities enjoy prosperity, the large centers of industry will likewise be prosperous. When farm products brought good prices the purchasing power and morale of the small community and the farmer were high, but at present, with eggs at ten cents a dozen, milk at a dollar a hundred pounds and wheat at sixty cents, the purchasing power of the small community is practically nil. And since the natural flow of money is from the small communities to the larger centers of trade, when this stream dries up, national resources also dwindle.

When it is considered that over fifty-four million of our people reside in rural districts and towns of 2,500 population and less, an idea can be gained of the necessity for raising the purchasing power of this group. The products of this group, which occupies 3,087 towns of 1,000 to 2,500 population and 10,346 smaller communities, furnish the resources for the purchase of manufactured articles produced in the larger communities, which large communities will in turn purchase the products of the small ones. There is thus a continuous chain of exchange. But links of this chain are now broken and it is necessary to weld it again into a perfect whole, and this must be done by the cooperation of the Federal government with the small community and the farmer.

If only a portion of the Refinance Corporation's funds were used for the small town, the distribution of money and credits here would do the most good in the shortest possible time. Support of railroads, land banks, finance companies, manufacturers and closed banks is of no great help to the final solution of the problem, for there can be no permanent solution until the consumers of the products of factories are able to purchase and pay for such products. Industry and the stock market, which are largely responsible for this condition, should put themselves on a basically sound footing; while the farmer and small-town merchant, who have been in no way responsible for it, cannot recover without outside aid.

To create purchasing power, there must be work; and the millions which would do little good if spent for erecting a skyscraper in a large city would do a great deal of good if spent in one hundred and fifty communities throughout the country; not in starting factories, for whose products there is now no sale, but in creating work where there was none before, and a kind of work that will consume materials without producing marketable goods. After this work has started the ball rolling, then factories can resume and business return to normal.

The plan proposed is to create, not a few large projects, but a large number of small ones which will so divide and diversify the work as to benefit the greatest number of people. None of this need be unnecessary work, for there is plenty of deferred construction, such as water works, sewers, pavements, municipal light plants and other municipal public works which, if constructed now, would be of great value.

Water works are, in most communities, a necessity and of economic value as a means of health and fire protection. Installed in a community of even 250 inhabitants, the saving in insurance premiums may be $350 a year, and the system can be self-supporting and show a net return of more than $300 a year. Sewers also are necessary for insuring satisfactory health conditions in a community.

Pavements should not generally be laid until the sewers and water mains have been laid, but there are many towns that have water and sewerage systems and no satisfactory pavements.

Work done now will have the advantage of present low prices and would provide work for the idle labor of the small town and surrounding territory. Thirty to 40 percent of the cost of the work would be paid to local labor and local merchants and would thus create a cash circulation in the town where the work was done. The balance, distributed widely in larger centers, would provide work for manufacturing plants, foundries and allied industries.

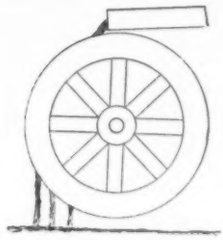
If the Federal government would finance part or all of the cost of such work in 10,000 towns and villages throughout the country this season, our troubles would be over. The total cost of such works might average $60,000 per town, or $600,000,000 altogether. Under ordinary conditions, about one-third of this cost would be paid by issuing bonds, and two-thirds by local assessments payable over a term of years, the assessment paper usually being sold to bond houses at par and 6 percent interest. But at present it would be difficult to sell either bonds or assessment paper.

It is suggested that the Federal government finance the entire cost of this work, furnishing the money for a one to twenty-year period with interest at 2 percent. The average return to the government would be $36,000,000 per year, which could be used as a revolving fund for future work should the necessity continue.

Should such a sum be spent in the small towns this year there would be a tremendous stimulation to business generally. Bathroom, kitchen and laundry fixtures would be installed, new dwellings and stores would be built and similar expenditures totaling $150,000,000 or more would immediately be made and paid for. This $750,000,000 cash so widely distributed would restore public confidence, provide the necessary purchasing power for the average citizen, and be the beginning of the normal employment of labor in the country as a whole.

The method of financing suggested is but one of several possibilities. But unless some plan be adopted for such widespread construction of small-town public works there would seem to me to be no other solution except the dole; for if there is no purchasing power there can be no business and our idle will increase.

THE WATER WHEEL



By
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The essential features of important articles of the month having to do with water works designs, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

MAY and June usually bring a flood of water works literature. The papers that have been given at the annual convention of the American Water Works Association begin to appear in the magazines devoted to the industry. Special issues intended to interest water works men are put out by several of the periodicals for display at the meeting. These special issues frequently endeavor to tell of new work, new processes and new equipment or they attempt to take stock of progress that has been made. The fact that the **New England Water Works Association** has lately completed **fifty years of distinguished service** to the water works industry[94] has emphasized the historical phase in the minds of many of those who have long been connected with the evolution of production, purification and distribution of water in the eastern portion of the country. Saville[97] has given a comprehensive and valuable account of the **development of the last fifty years** in water supply, while Armstrong [82] has compiled a historical summary that goes far back into antiquity. Hinman[156] and Spaulding[7] have passed over the historical phases lightly in analyzing the **tendencies of the moment in water treatment** and in endeavoring to forecast the developments that the **future** will require. Gibson[158] has given complete freedom to his imagination and to his knowledge of the difficulties of many water departments in envisioning a **Utopian water department,** tho Utopia is probably still as far away as ever. Perhaps it is even farther away than it was two years ago, in spite of the fact that the water supply industry has shown surprising stability in time of depression[88]. Everyone will agree theoretically with Pirnie[89] that **now is the time to make water works improvements**—or at least for the other fellow to do so, but the actual work is slow in getting under way. Those communities that have available funds are at great advantage now. Those that must raise the money by bond issues, or look to any other unwilling source, may find it difficult to profit by the present opportunities. Private companies whose securities have been so seriously depressed can hardly expect a frightened public to buy more securities at a price sufficient to yield the funds for needed extensions. Siems[159] discusses the stabilizing effect and the **help to investors** which would result if the utility companies themselves could buy back their own securities or advance loans to the persons who have invested money in these utilities. Kansas City, Missouri[164] is among those communities which have attempted to **lay mains with large rotating forces** of unskilled, jobless men. Although they had difficulties with a 42 inch line on account of weather conditions, it is reported that the work was completed satisfactorily and without prohibitive cost.

An international congress of **water diviners** convened in Verona, Italy, in March. They discussed the "science" of **rhabdomancy** at length and propounded some astonishing theories. About 200 persons were present. In objecting to the flippant manner in which the congress was discussed in the technical press, Yerbury[23] claims that in 1926, Major C. A. Pogson was appointed official diviner to the Government of India with significant results. In America the American Geophysical Union has set up nine committees and plans to push **research in hydrology** in a vigorous manner. The **snow records** in California indicate a good water year for 1932[32]. Undoubtedly this is welcome news for those who have had to surmount **drought emergencies** in Santa Barbara[83], in San Francisco[77], and elsewhere in the region concerned. Meinzer[129] reviews the methods which have been used to estimate the available **ground water** supplies. Whitman[81] reminds us of the highly variable **demand for water** of different communities. Each community is a special case and the most carefully thought out calculations may be set at naught, if, as in the instance of Cumberland, Maryland, a single industry coming into the city requests the water department to supply it with almost as much water as the city at the time consumes. Provision to meet such a demand requires added expenditures which in turn would involve a severe loss if the industry should shut down or move away. Nevertheless most towns consider it wise, and good economy, to provide for tremendous and sudden increase in the water demand for **fire protection.** Yet Mowry[100] says that less than 1% of the water pumped by a community is thrown on fires. Of course the matter of fire protection and the matter of supplying water to the industry are fundamentally different. The industry requires a continuous supply which must be sought and found. The fire protection requires a large volume of water to be on hand for an emergency and ample facilities to deliver it where it is needed. The fire protection need does not necessarily require development of additional sources.

There have been important recent developments in **elevated tanks** made possible by the use of welded construction instead of the older riveted type[6]. Beauty in tank construction has been sought and towers such as the splendid Allen Hazen water tower in Des Moines[145] have done much to remove the objection to the erection of such structures in high-class residential districts. There is evidence that the demand for architectural embellishment of water towers is felt even in China. Apparently pagoda-like water towers have been erected there[49].

Allen[2] asserts that the **pumping installations** in 1931 were fewer in number, but generally larger in size than

in 1930. He believes that this situation was due more to the drought and to the hastening of completion of pumping installations in 1930, rather than to the current financial depression. Reynolds[47] claims that by **adjusting the pressures** maintained at the different pumping stations so that 25 pounds per square inch could be maintained at the extreme ends of the mains, Chicago has saved more than $70 per day. McDonnell[161] calls attention to the economies of **Diesel engines** for water service. Incidentally he calls attention to the fact that water is often delivered to consumers at points long distances from the pumping plant at prices in the neighborhood of 2 cents to 5 cents per ton. Brossman[41] also considers the modern sources of **power** for the water works plant. Gordon[44] confines his study to **deep well pumping economies,** pointing out that greater efficiency is obtained with plunger and turbine type pumps than with air lift, but that the air lift requires less maintenance and can operate in wells that are neither plumb nor straight.

The relation of the water distribution system to other **underground utilities** and the need of a well developed plan for these structures is discussed by Harrison[16] and Horner[17]. Goldsmith and Tatnall[40] demand **dependable hydrants** adequate for fire protection. Tables for the flow of water in **rubber-lined** hose are given by Power[108]. Harris[150] says that the California Water Service Company has standardized on copper tubing and cast iron pipes of small diameters for **services.**

LeGrand[62] claims that laminar friction, skin friction and turbulent friction are all correlated with velocity and viscosity in determining the total **friction losses in pipe fittings.** He has devised special designs for tees, ells and a globe valve for reducing turbulence. Cranch[142] describes the extensive **meter repair services** supplied by the New Rochelle, N. Y., water company for their patrons and those of other companies located near by and under the same ownership.

Current tendencies in water treatment place much greater stress on **preparation of the water for filtration** than on the filter itself. The filter finds a champion in Hungerford[147] who feels that the rapid sand filter has been unjustly neglected. He claims that the **modern high velocity wash** originated with Isaiah Hyatt in 1898 and that mechanical rakes and air agitation with low wash water velocities were more efficient in maintaining the filter bed in good condition than some of the later designs. Morrill[45] tells of the changes from the usual design which have been incorporated in the new 280 Mgd. filter plant at Detroit as a result of the research work conducted in preparation for the new plant. Among these innovations are straight flow basins, 20″ filter beds, intense filter washing, small wash water tanks and an increase in filter rate to 160 million gallons per acre per day.

Flocculators developed at Richmond, Virginia, have greatly improved the clarification of Richmond water in preparation for filtration in the opinion of Marsden C. Smith[141]. These devices are in the form of paddle wheels with narrow blades, slowly revolving about a horizontal axis.

The operation of **Aer-O-Mix** type units at Waukegan, Illinois, is described by the inventor, Colonel Henry A. Allen[9]. Similar devices have given satisfaction, with material economy, at Lynchburg, Virginia, supplanting spray-type aerators[146].

Taste and odor removal continue to occupy the center of the stage at most gatherings of water works operators. Norman J. Howard[154] summarizes the state of the art and the methods currently available to remove odors and tastes from water. Bauermann[79] discusses the advantage of the **ammonia-chlorine process.** The longer period of chlorine retention and of action on algae are helpful under the conditions met at Newark, N. J. Many operators have reported success with **activated carbon** as a taste and odor remover[154]. Stuart[152] finds that activated carbon may also **remove color** from water and lower the required alum dose in soft, clear water. A number of British power plants, notably the installation at Barking, are **chlorinating condenser water** with success[125].

The story of the **crawfish that held the check valve open** in the cross connection line, may be found in the February number of the Monthly Health Bulletin of the Connecticut Department of Health[105]. But the gate valve saved the situation. A case of infestation by the fluke, **Schistosoma hematobium,** in a child in Chicago, was apparently traced to snails in an aquarium containing tropical fish[76]. This is a very serious type of parasitic infestation in Egypt. The older name for the organism was Bilharzia. A number of cases of infestation with the **guinea worm** have been reported by Captain Gore[101], of the Indian Medical Service. In the case of one sepoy a period of ten months elapsed from the last opportunity of contact with the infested native well, to the appearance of the worm. Kalantarian and Petrossian[167] report on a new species of **bacterium which precipitates calcium** from waters, but does not precipitate magnesium to the same degree. A study of the influence of the fresh water mussel on the bacterial content of water was carried out by Moon and Glenn[89]. They concluded that instead of reducing the numbers of bacteria in the water, the presence of the mussels might even result in increased bacterial content.

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131. Water Analysis for Sanitary and Technical Purposes, Herbert B. Stocks, a Review, "B.A.A." pp. 149-150.
132. Abstraction of Water from a Stream by Infiltration, John Watson, pp. 151-152.
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134. Kent's Rain Gauge: Syphonic Type for Catchment Areas, Anon., pp. 155-156.
135. The "Rose" O. H. Tank Water Level Indicator, Anon., p. 156.
136. Centrifugal Pump Testing Plant, H. Cardinal von Widdern, pp. 157-159.
137. The Lloyd Barrage and Canals: Sluice Gates in the Barrages and Canal: Excavation and Costs, Anon., pp. 160-163.
138. Current American Water Works Practice: River Water for Drinking: Taste and Odor Elimination, W. Gordon Carey, pp. 169-170.
139. Recent Practice in Australian Water Supplies, Continued, S. McConnell, pp. 171-174.
140. An interesting Device for Gauging Depths of Water in Wells, R. Butler, p. 174.

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*141. Improved Mechanical Treatment of Water for Filtration, Marsden C. Smith, pp. 103-106.
142. Meter Maintenance at New Rochelle, N. Y., E. T. Cranch, pp. 107-109.

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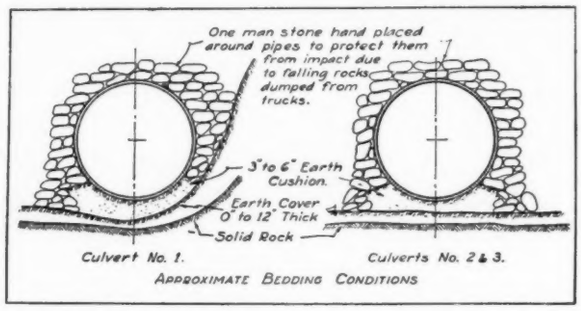
Incineration of Sewage Screenings and Sludge

An article with this title in our May issue, page 22, was accompanied with an illustration bearing the caption "Incinerator for burning two tons per hour of coarse and fine sewage screenings: South Yonkers plant of Westchester Sanitary Sewer Commission, located near large girls' school and an orphan asylum, and beside main line of the New York Central Railroad." The object of this illustration was to show a plant which burned sewage screenings on a site where a nuisance would not be tolerated.

It has been suggested that some readers might assume that screenings incineration was the sole purpose of the fine large building shown. Such a thought had not occurred to us, since capacity for burning two tons per hour would require only a small part of the area covered by this building. As a matter of fact, it houses the largest sewage treatment and sterilization plant of its kind in the country, of which the incineration of the screenings is but one feature. There are two incinerators, a Decarie fine-screenings furnace and a Morse-Boulger furnace, each of which burns one ton per hour. The entire plant was built by the Municipal Sanitary Service Corporation.

Highway Engineering



Approximate bedding conditions of the culverts.

Loads on Culverts Under Rock Fills

EXPERIMENTS and investigations by the Iowa Engineering Experiment Station indicate that embankments and trench back-fills over sewers and culverts follow the same laws as to pressure on the pipe when made of rock as when made of gravel, clay or loam.

This experiment station has for more than twenty years been studying loads on conduits in trenches and under embankments, and Anson Marston, director of the station, has developed a theory of the external loads on such conduits which has been generally accepted as correct.

All of these experiments, however, have been conducted with gravel, clay or loam materials, and it was not known what the action would be of an embankment constructed of material from rock excavation. There is a feeling among engineers that rock fills "arch over" a culvert and do not exert the full theoretical load upon it. When, therefore, it was learned that the Iowa Highway Commission was to construct three pipe culverts under rock embankments, the experiment station decided to study the pressure effects of these.

The results of this investigation are embodied in a report by the experiment station, entitled, "Investigation of Loads on Three Cast Iron Pipe Culverts Under Rock Fills." According to this report:

> The investigation has been productive of results. Conclusive proof has been obtained which shows that the rock fills acted in a manner quite analogous to an earth fill and that loads were produced on various sections of the culverts, in accordance with Marston's theory. Concrete evidence is presented to show that the load on a culvert is not a direct function of the height of the embankment, but that the relative settlements of the culvert and various horizontal planes of the embankment must be taken into account if the loads are to be determined. The importance of the character of the bedding of a culvert is also clearly demonstrated.
>
> Although two of the three culverts studied failed structurally, they failed solely because the pipes were overloaded. There is no evidence to indicate that the pipes used in the culverts were of an inferior quality nor that they did not support the full load which they should have been expected to safely support.
>
> Extensive experimental observation of loads on culverts under earth embankments have shown that maximum loads do not develop until considerable time has elapsed after the embankment has been placed. There is evidence that the rock fills over the culverts included in this study acted in a similar manner. Within a period of 20 months the number of cracked sections in one of the culverts increased from 5 to 16, and this progressive cracking undoubtedly indicates an increasing load.

The culverts were installed by the grading contractor and, although the work was well and carefully done, there was not the care and control which has characterized the experimental culverts constructed by the experiment station. The pipe used was of cast iron with a shell thickness of ½ inch, with spiral corrugations permitting consecutive sections to be threaded together, the pipes being alternately 36 in. and 37.5 in. inside diameter. They were 3 ft. 3 in. long, the smaller being threaded 3 in. into the larger one at each end. Results showed that the thickness of these pipes was not sufficient for the loads they had to carry at the deepest fill. The maximum fill in culvert No. 1 was 19.3 ft.; 27.4 ft. in culvert No. 2 and 20.2 ft. in culvert No. 3.

The culverts rested on rock on which was spread a layer of earth from a few inches to a foot thick to give a uniform bearing. The embankment materials consisted of limestone rock from rock cuts varying in size from chats to rocks 3 to 4 ft. in dimension, all jagged and irregular. The pipes were first surrounded with one-man stone placed by hand in a more or less horizontal position to protect the pipe from large stones later dumped onto the fill, which result was apparently effected; but the further idea that the rocks so placed would arch over and relieve the pipe of some of the load was apparently unwarranted.

The unit weight of the fill material varied considerably but probably averaged about 140 pounds per cubic foot. The coefficient of internal friction was difficult to determine, but the natural slope of the embankment seemed to run about 1.4 to 1, which corresponds to a coefficient of about 0.7.

Culverts Nos. 1 and 2 were inspected in April and October, 1929, and in May and November, 1930. Practically every section in each culvert continued to settle further into the bedding during the entire 20 months, some of them in No. 2 as much as a total of 6½ to 7 inches. This was considered due to a gradual increase of the load upon the pipe corresponding "to the phenomenon of load lag which has been so consistently apparent in the culvert load experiments conducted by the Iowa Engineering Experiment Station." Sixteen sections in the middle of No. 2 cracked and bulged up on bottom, apparently indicating that the pipes had settled until resting upon rock in the bed. These pipes did not collapse, although in some the vertical diameter shortened from 3 to 4⅛ inches and the horizontal diameter lengthened 2 to 2.88 inches.

In culvert No. 3 practically all the sections failed within a few months, even those with not more than 5 feet fill over them, and the entire culvert collapsed.

No satisfactory explanation of this was found, the most probable being that, as the pipe was laid in very cold winter weather, the earth bedding froze solid and did not allow the pipes to settle into it to a uniform bearing.

The report gives the measurements and other data obtained, discusses them, and draws the following conclusions:

1. There is every evidence that the rock embankments over these culverts acted in a manner entirely analogous to the action of ordinary earth embankments.
2. Marston's theory of loads on conduits due to fill materials is substantiated by this investigation. All the observed phenomena are readily explained by means of this theory.
3. The earth cushion on which the pipes were laid proved to be the salvation of culvert No. 2 by allowing the pipes to settle appreciably, thereby reducing the settlement ratio and the load. Otherwise this culvert would, in all probability, have been completely destroyed. Although a similar cushion was placed under culvert No. 3 it was not effective in reducing the load on this culvert because of freezing weather at time of placement.
4. The load on culvert No. 1 was materially lightened by the fact that it was built at the base of a sharp rise in the natural ground which produced conditions characteristic of ditch conduits on one side of the culvert.
5. The phenomenon of load lag is very well demonstrated in the case of culvert No. 2. The first inspection of this culvert after the embankment was placed revealed five cracked pipe sections. Each subsequent inspection revealed additional cracked sections and at the time of the last inspection, 20 months after the first, there were 16 cracked sections. This progressive development of cracks must be attributed mainly to increasing loads, even though no additional fill was placed.
6. There is nothing revealed by this study to indicate that the pipes used in culverts Nos. 2 and 3 were of inferior quality. They were merely loaded beyond their capacities.

Three suggestions are offered of "methods of construction which might have been utilized to render culverts Nos. 2 and 3 safe under the weight of fill to which they were subjected."

Method No. 1. Place the fill in the ordinary manner up to 5 or 6 feet above the top of the culvert. Remove all the material directly over the culvert and replace it with material having a much lower modulus of compression such as straw, brush, or (in this case) ordinary earth. Then continue the embankment up to grade. Experiments show that this produces marked reduction in loads on conduits by insuring that the friction increment will act upward.

Method No. 2. Excavate a trench about the same width as the culvert, 2 or 3 feet deep and extending the full length of the culvert, and refill with clay, loam or other material having a much lower modulus of compression than that removed. Bed the pipes in this material with a projection ratio of 0.6 to 0.7. When this method is employed the culvert should be laid with the flow line on a camber, to allow for settlement.

Method No. 3. Placing concrete cradles under the pipe has been suggested, but the author of the report, Merlin G. Spangler, believes this would only have aggravated the results, since, although it would have increased the supporting strength, it would also have increased the load by preventing settlement—in this case giving a load 2 to 2½ times that which the culverts were actually called upon to carry, while increasing the supporting strength 1½ to 2 times.

Construction Equipment and the Gas Tax

The California Supreme Court, Oswald v. Johnson, 291 Pac. 579, holds that rollers and tractors used in the construction or repair of a highway closed to the public are not being "operated upon" a public high-

way, and therefore are within the gasoline tax exemption of Cal. St. 1925, p. 660, §4, amending St. 1923, p. 575 §11, which authorizes the refund of a license tax for any motor vehicle fuel for purposes other than in motor vehicles operated or intended to be operated upon the public highways of the state.

In Allen v. Jones, 47 S. D. 603, 201 N. W. 353, it was held that a traction engine while in use in the construction of a highway is not "operated upon a highway" as contemplated by a similar exemption in the South Dakota Gasoline License Tax Act. In that case, however, it was observed that motor fuel used in propelling tractors or trucks in the transportation of road building material or motor fuel to or from the site of construction is used in "operation upon" the highways and is not purchased subject to the refund.

Day Labor Costs on Bituminous Macadam

By M. J. O'Neill, Town Engineer of Easthampton

In the spring of 1931, $26,000 was available for constructing a bituminous macadam pavement on Holyoke St., Easthampton, Mass. As a large number of able-bodied men were receiving aid from the Welfare Department, it was decided to do the work by day labor and use as little equipment as possible.

Granite curbs and a drainage system had been constructed previously, but several catch basins and connections, curb inlets and manholes remained to be built. The total length of the job was 3,650 feet, 3,200 feet of this averaging 31 feet width, the remainder 26 feet. The road was closed to traffic the greater part of the time.

The state contributed $10,000 to the cost and the county $6,000, and the work was done under state specifications and supervision. These specifications called for 6" gravel foundation, 3½" broken stone base course, and 2½" broken stone wearing course penetrated with 2¾ gal. of asphalt binder.

The gravel was loaded by hand and hauled 5 miles by trucks, payment for haul being ¼ cent per cubic yard (pit measure) per 100 feet haul, 1 cu. yd. pit measure being taken as 1.15 cu. yd. loose measure. This price was considered too small for 1 and 1½-yard trucks and these discontinued hauling.

Excavation in the street was loaded by hand and disposed of on side streets from ¼ to 1½ miles distant. In this work the pay for trucks ranged from $1.50 per hour for hand hoists to $2.00 for power hoists and all sizes from 1 to 3-cu. yd. were used.

The number of men employed at any one time varied from twelve to sixty. The work was completed in two months. The writer had general supervision of the work for the town and L. D. Parker was resident engineer for the state.

The work cost $1.86 per square yard, exclusive of drainage, and the total cost averaged $2.04 per square yard. Of the total cost, 46% was for labor, 45% for materials and 9% for trucking. The itemized cost was as follows:

Analysis of cost of bituminous Macadam road on Holyoke Street in Easthampton, Mass.

Item	Quantity		Expended	Unit Cost
Excavation	4,500.	cu. yd.	$4,874.32	$1.08
Gravel foundaton...	2,388.7	cu. yd.	3,591.90	1.49

*Sand (Base course filler)	229.5	cu. yd.	628.72	2.74
Drainage, manholes, catch basins and concrete inlets ...			1,424.49	
Broken stone:				
†Hauling	4,010.45	tons	2,406.21	.60
Spreading	4,010.45	tons	2,609.00	.65
Cost of stone f.o.b. quarries.	4,010.45	tons	5,854.08	1.46
§Bituminous material.	32,226.6	gal.	3,071.14	.095
Traffic men			522.52	
Fine grading, rolling and finishing			742.74	
TOTAL			$25,807.46	

Total labor, $11,851.00; Trucking, $2,377.00; Materials, $11,579.18

* Cost includes labor loading by hand, hauling, spreading. No cost of material or trucking included.

† Average haul nine miles from Holyoke Street railway quarries at Mt. Tom.

§ Cost includes applying, as binder, Beacon Asphalt, furnished by New England Asphalt Distributing Co.

Effect of Testing Machine on Determination of Concrete Strength

Concrete pavements are now very generally opened when the breaking strength or modulus of rupture of beams which were made at the time the slab was placed reaches some specified value. Various types of portable or semiportable machine are used for breaking these beams, and the question of the comparative values given by different types of machine under actual field conditions is therefore of prime importance.

The U. S. Bureau of Public Roads, with the cooperation of the Tennessee Dept. of Highways and Public Works, has studied the values obtained by two different types of beam-breaking machine, comparing them with each other and with the values given by 2-point loading in a universal testing machine.

The machines in common use are apparently satisfactory so far as breaking the test specimens is concerned, but differ widely in the amount of shearing stress imparted while developing the necessary bending moment. Briefly stated, results obtained by a multiple-lever field machine exceeded those obtained by an improvised single-lever machine by an average of 26 percent; while the results by the universal machine exceeded those of the single-lever machine by only one percent.

The studies led to the following conclusions:

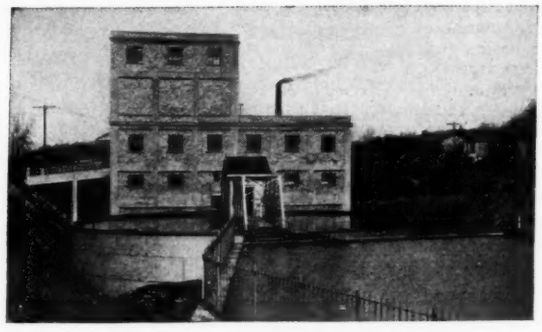
1. The breaks on the beams broken in the multiple-lever machines showed that a much larger percentage of the rock was broken than in the other machines.

2. The type of machine used to make the break will determine to a large extent what breaking strength will be obtained.

3. The results show that the apparent quality of concrete, as indicated by test specimens, may be varied by merely changing the apparatus for breaking specimens. They may also help to emphasize why a more standard method of making and especially of testing beams in the field should be adopted.

4. It would be advantageous if every field machine could be calibrated against the standard laboratory set-up before it is placed in service. As these field machines frequently receive very rough treatment it might also be desirable to have this calibration rechecked before the beginning of each subsequent construction season.

Sanitary Engineering



Bronze Bolts in Water and Sewage Plants Fail

In describing the Akron, Ohio, sewage treatment works at the Ohio Conference on Sewage Treatment, T. C. Schaetzle, engineer-chemist of the works, said that "Quite a few leaky valves developed on the water supply pipe lines. When these were uncovered it was found, in every instance, that the bronze bolts which couple the bonnets to the body of the valves had failed. The original bolts were ⅝" bronze and were replaced with steel bolts." Twenty-five percent of the bolts failed and were replaced.

In discussing the paper, W. A. Kivell, sanitary engineer with the Dorr Co., stated that bronze bolts had at first been used for fastening screen plates on the Dorrco screens, but their continued failure caused the company to substitute steel bolts for all recent construction.

A. H. Fretter, superintendent of the water purification and sewage treatment plants at Medina, said that eight or ten years ago Swedish iron bolts, used on certain equipment, failed and were replaced with bronze bolts. These also failed rapidly and were replaced with rolled phosphor bronze which, when inspected recently, were found to be almost as good as new.

Robert A. Allton, sewage disposal engineer at Columbus, also had found bronze bolts unsatisfactory and at present is specifying monel metal. M. W. Tatlock said that at the Indianapolis sewage treatment works bronze bolts secured weir plates on the adjustable weirs of the secondary settling tanks, and whenever the plates were adjusted the application of a wrench to the nuts invariably twisted the bolts off.

Eliminating Tastes from Cincinnati's Water

From the middle of December, 1930, to along in February, 1931, the water of Cincinnati, Ohio, had an intensely disagreeable musty or stagnant taste, due, according to Clarence Bahlman, water purification supervisor, to profuse development of vegetable growths and algae following the prolonged drought. As often happens, the tastes were intensified by use of chlorine, and to prevent this, high lime treatment was substituted during the period from January 24th to February 17th, but the taste persisted.

Meantime dozens of purification plants which were similarly troubled, together with several state health departments, were searching for a remedy and comparing notes. As a direct outcome of the studies of the Cincinnati laboratory and a critical survey of experiences elsewhere, two noteworthy improvements were made at the Cincinnati plant during the summer, namely the purchase of equipment and materials for use of the ammonia-chlorine process and of powdered activated carbon. The former process has been used without interruption since early in July, at an additional cost of about 24 cents per million gallons. The cost of the apparatus, a Pardee control unit and a 5,000 pound platform scale, and steel housing was $1248.

Activated carbon was chosen to remove pre-existing tastes in the raw water. This condition is to be expected only at low river stages following prolonged dry periods, and as yet there has been no occasion to use the process, but it can be put into operation on a few hours notice.

"With these two processes we hope," says Mr. Bahlman, "to reduce the occurrence of distasteful water by at least 80 per cent. Under extreme conditions we may not be entirely successful, but even then a marked reduction in the intensity of the taste is certain to be accomplished."

Making the Sewage Plant Attractive

In his annual report for 1931, Morris M. Cohn, sanitary and testing engineer for the Dept. of Public Works of Schenectady, N. Y., in connection with his usual complete report concerning the operation of the sewage treatment plant, tells of the effort made to keep it not only clean but attractive in appearance. This part of the report was as follows:

The structures, grounds and treatment devices were maintained in excellent physical appearance by the program of repairs carried out during the year. The plant has looked neat and inviting as a result of the efforts of the men to maintain cleanliness.

The buildings were given the usual amount of repairs. The interior of the main building was repainted and all woodwork revarnished during the winter months. The floors of this building and of the laboratory were enamelled on two occasions. The office furniture was supplemented by a desk, a typewriter desk and several chairs. In the laboratory, a sink and gas connections were installed in the small special material testing room.

Outside trim was repainted and the main building was fitted with screens and a screen door. Flower boxes were built in this building for the purpose of growing slips of annual plants for outdoor use next spring.

The grounds were kept in their finest condition. The lawns

were seeded, rolled and kept trimmed during the entire summer. Additional flower beds were again put out and a new stretch of lawn was filled and seeded over the trunk sewer section. The roads were kept raked and cleaned. Low spots were filled with crushed stone. Steps around the plant were rebuilt. A series of four trellises and wing fences were placed in front of the filters and rose bushes were planted here. Two rows of perennials were set out along the laboratory walk. The flower bowls on the tanks and filters were filled with vines and geraniums in summer and with evergreens during the winter. The main section of the dikes and all the plant flats were kept cleared of brush.

On the tanks, the gas vents were again rebuilt as found necessary. The vents, all iron work and piping were painted with aluminum paint. This paint has withstood the action of the sewage gases splendidly and will be used here exclusively. Channel bridges were rebuilt and repainted. A small amount of concrete patching was carried out.

All the sludge beds were resanded during the spring months. A total of 338 cubic yards of sand was used. A survey was made of the property line along the east dike of the plant and it was found that an area of sand spoiled by the state during river dredging operations belonged to the Bureau. A roadway was cut to this sand, trees and brush cleared and a splendid source of sand made available for plant use.

In the spring, the Bureau had approximately six acres of land around the plant plowed and staked off into 60 garden plots. A map was made of the garden areas and the lots given for use to those persons who applied for them. The lots were all taken rapidly and garden truck was raised for some sixty families. A close check was maintained over the gardens, identification cards were given out and all strangers barred from the lots. The free distribution of plowed land was an innovation which did much to arouse friendly comment. It is intended to continue this practice until the land is needed for plant expansion. Sludge experimental work may be possible here in the near future.

Lowering Refuse Disposal Costs in Dearborn

The unit cost of garbage collection and disposal by Dearborn, Mich., has been dropping steadily for three years. For the fiscal year 1930-31 it was $7.29 per ton, against $10.00 for 1929-'30. Of this $2.71 reduction, $1.80 was due to the fact that the garbage was taken by farmers. There was no increase in equipment or personnel, partly because of better management and partly because the amount of garbage fell off immediately after each factory lay-off.

The total cost for 1930-'31 was $32,156; of which $28,745 was for wages, $971 for equipment and $281 for equipment maintenance, and truck repairs, gas and oil made up the balance. The garbage collected totaled 4,582 tons.

Rubbish costs also fell from $1.22 per cubic yard in 1929-'30 to 79 cts. in 1930-'31. Sorting the rubbish made it possible to dump it in nearby places that could not have been considered otherwise. The cost included $22,532 for wages, $2,515 for truck repairs, gas and oil, and $425 for disposal; a total of $25,472 for collecting 32,122 cu. yds.

Cast-Iron Services and Concrete Manholes

The report of C. E. Van Hecke, superintendent of the city water department of Stevens Point, Wis., for the year 1931, although brief, contains several interesting features and indicates an up-to-date plant serving 2,600 consumers.

Since 1926 all services have been metered. Since 1929 no pipes smaller than 6-inch have been laid.

Concrete manholes are built to give access to valves on mains and hydrant branches, and also on services (as described below). There are 157 for main valves,

154 on hydrant branches, and 741 on services; all services laid during the past six years being so provided.

Since 1925, about 90% of the services have been laid as 2-inch dual lines, each serving two or more consumers. These dual lines are laid with 2-inch cast-iron pipe to a manhole outside the property line and on a continuation of the dividing line between two adjacent properties. Here there is a branched valve, from which consumers' private lines lead to the two properties, there being a meter on each line, also located in the manhole. Where individual lines are laid from the main, these are of 1½" cast iron. No steel or wrought iron is used.

Last year 229 dual services were laid, 10 individual lines, and four 4" and 6" for large consumers, several to replace steel services. On these were located 235 concrete manholes 27" diameter and four 33".

The Water Wheel

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143. Keeping Rapid Sand Filter Beds in Good Condition, John R. Baylis, pp. 124-126.
144. Horizontal Casting of Pipes by the Green Sand Multiple Gate Method, Porter W. Allen, pp. 127-129.

n145. The Allen Hazen Water Tower, Anon., p. 129.

146. Aeration and Mixing Device Accomplishes Marked Savings and Efficiencies at Lynchburg, Va., pp. 141-144.
147. The Discredited Filter, Churchill Hungerford, pp. 145-148.

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148. Raw Water from Lake Michigan Filtered and Sterilized at the Sheboygan Purification Plant, Jerome C. Zufelt, pp. 424-426 and 455.
149. Control of Water Purification Processes, IV, Charles R. Cox, pp. 427-429.
150. Service Pipe Practices, H. A. Harris, pp. 430-432.
151. Legal Obligations and Liabilities of Parties to Water Works Contracts, Leo T. Parker, pp. 433-436.
152. Tea-Color of Water Corrected by the Use of Activated Carbon, F. E. Stuart, p. 436.
153. Interpretation of Water Analyses Simplified by Table, Norman C. Wittwer, pp. 436-438.
154. Use of Activated Carbon for Taste and Odor Removal, Questionaire Replies, pp. 444, 447-448, 451-452, 455.

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155. Memphis, Tenn., Rushing Completion of the World's Largest Well System, Anon., pp. 502-504.
156. Progress in Quality of Water, Jack J. Hinman, Jr., pp. 505-508.
157. Cuban Water System is Managed and Operated by an American Utility, George W. Biggs, pp. 509-512.
158. A Utopian Water Department, James E. Gibson, pp. 513-516.
159. A Plan to Provide for the Purchase of, or Loans on Public Utility Securities, V. Bernard Siems, pp. 517-518.
160. Presumptive Test for B. coli, (Article V.) Charles R. Cox, pp. 569-571.
161. Facts and Figures Concerning the Operation of Diesels for Water Service, Robert E. McDonnell, pp. 572, 575-6. To be Continued.
162. The Water We Drink, Caleb Mills Saville, pp. 579-580, and 583. To be Continued.
163. Only 5 Miles of Tunnel Remain to be Excavated on Hetch Hetchy Project, M. M. O'Shaughnessy, pp. 584 and 587-588.
164. An Account of How a $1,000,000 Water Main Extension Program in Kansas City, Missouri, was Carried Out by an Unskilled Army of 2000 Jobless Men, Anon., pp. 591-592.
165. Clarksville Plant Improved, C. N. Harrub, pp. 595-596 and 599.
166. Freeing the Superintendent from Political Control, Questionnaire Replies, pp. 600 and 603.

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167. Ueber ein neues kalkfällended Bakterium aus dem Sewan. See (Gotschasee) Bact. Sewanense, spec. nov., P. Kalantarian and A. Petrossian, pp. 431-436.

Crawfish Holds Check Valve Open

In 1926 the Connecticut State Department of Health promulgated sanitary code regulations prohibiting new cross connections between potable water systems and unapproved auxiliary water supplies and allowing old connections only if provided with double check valves of special design equipped with drip cocks and gages for testing. The vast majority of cross connections were eliminated at that time, but there still remain 166 check valve installations, mostly on large water connections to factories. These are

subjected to rigid inspection every three months by an inspector of the State Department of Health. Comparatively few valves are found to be leaking. If a valve leaks upon test, it is immediately opened and repaired. Yearly overhauling of valves is required.

An interesting cause of valve leakage was encountered during an inspection a few weeks ago. When the test showed the valve to be leaking, the inspector immediately asked to have it opened up. It was found that a live crawfish, having an extreme length of 6 inches, had in some way entered the water main. Apparently it was passing through the check valve, the valve had closed and the claws of the crawfish were holding the valve open. The second valve was holding tight, however, so that no polluted water was getting into the public main. This calls attention to the need for careful supervision of such check valve installations; also for double check valves.

Increasing Dissolved Oxygen in Ice-Covered Ponds

During the winters following the past three or four dry seasons, lakes used in connection with the Iowa fish hatcheries became very low and deficient in oxygen, to the detriment of the young fish. S. P. Baur, state fish culturist, decided to try artificial aeration and during the winter months of 1930-'31 all of the ponds less than 7 feet deep were tested twice a week for dissolved oxygen and when this became dangerously low air was introduced by air compressors.

Last fall the method of introducing air was improved, use being made of a portable blower outfit

Portable blower for aerating ponds

developed with the cooperation of engineers of Roots-Connersville-Wilbraham. As used last winter, a 50-foot section of hose attached to the blower was pushed under the ice through a hole cut therein, the hose being suspended from 2x6's spliced together so that the hose was at least 3 feet above the lake bottom, and air blown through it. The escaping air made a hole in the ice above the end of the hose, but when this began to appear the hose was at once swung around in a circular arc to a new position to prevent the escape of air, and this was repeated until it had made a complete circle, when the outfit was moved to another point and the operation repeated.

The air so injected was confined by the ice and presumably collected under it so that what was not absorbed during the operation was later absorbed slowly at the surface of the water.

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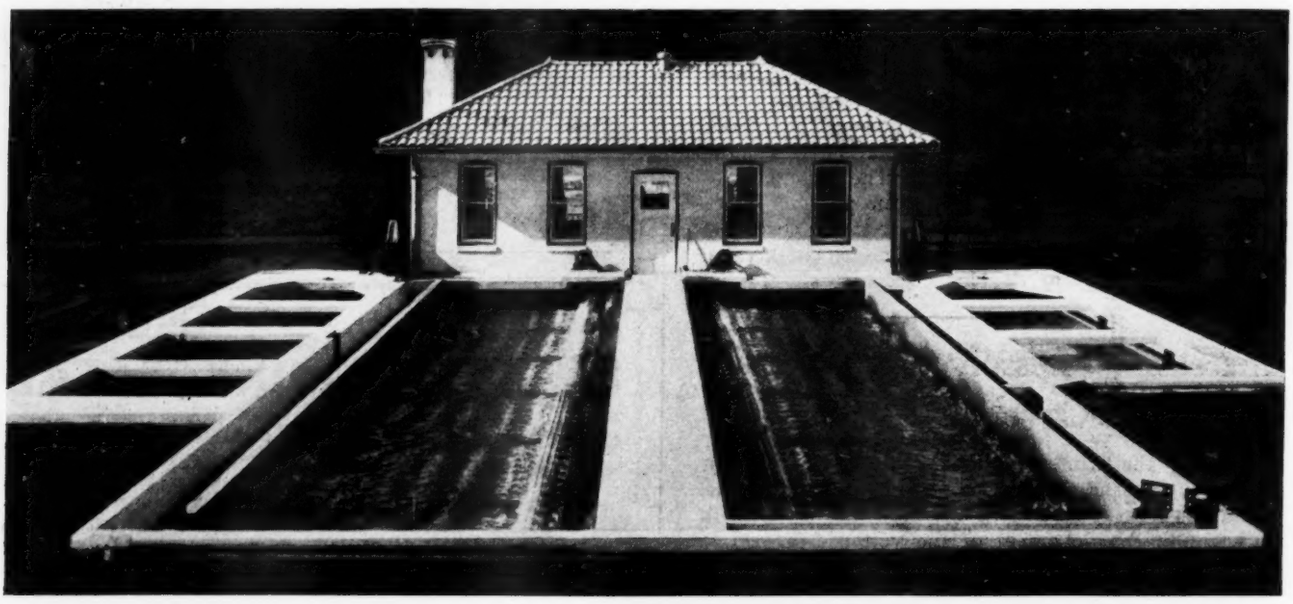
"One of the Finest Little Plants in the Country"



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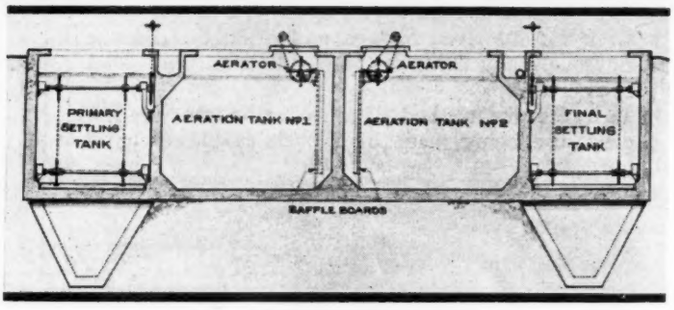
(Thomas F. Bowe, Consulting Engineer)

A beautiful Link-Belt equipped plant that delivers a very good effluent. The suspended solids in the influent vary from 80 to 140 P.P.M., and the B.O.D. varies from 100 to 250 P.P.M. The effluent has at all times the clear sparkling appearance of drinking water. It has a dissolved oxygen content of 5 to 10 P.P.M., and a B.O.D. of not more than 8 P.P.M.

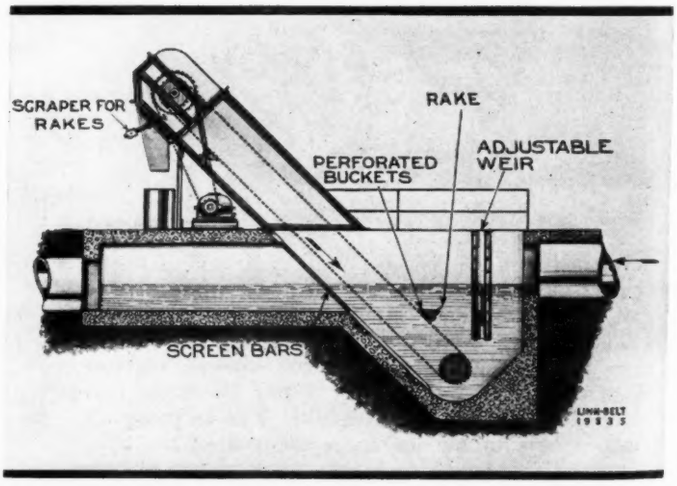
The plant is designed for a flow of 500,000 G.P.D. The mechanical equipment consists of a Type "C" combined screen and grit chamber, Straightline Collectors in the primary and final tanks, and Straightline Aerators in the two aeration tanks. The power consumption of the five units is only about 162 K.W. per day.

The Type "C" Combined Screen and Grit Chamber has thoroughly proved its value for medium and small activated sludge plants. Straightline Collectors and Aerators are made in sizes to suit any requirements.

4542



Section of Tanks



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Bids Wanted
Streets and Roads

Ill., Springfield— 10 a. m., June 15
Pav. 19.18 mi., grad. 24.04 mi. 30.66 mi. sects. in combinations, in var. counties.—Dept. Pub. Wks., Div. of Hwys., Harry H. Cleaveland, Dir., Springfield. (Frank T. Sheets, Chf. Hwy. Engr.)

Ia., Cedar Rapids— 10 a. m., June 9
Constr. sidewalks in sidewalk order No. 1, abt. 39,000 sq. ft. conc. 5 in. in depth.—L. J. Storey, Clk., City Hall.

Ia., Lorimor— 4 p. m., June 9
Curb., gutter., pav. etc. on sts.—W. C. Grandfield, Clk., Town Hall. (Henningson Engrg. Co., Engr., 326-30 Union State Bank Bldg., Omaha, Nebr.)

Ia., Mount Ayr— 7:30 p. m., June 13
Constr. pav. with curb. and gutter.—G. Add Tenant, Town Clk., Town Hall. (Henningson Engrg. Co., Engr., 326-30 Union State Bank Bldg., Omaha, Nebr.)

Kans., Salina— 9 a. m., June 10
Bit. mat. surfac. 25.043 mi. co. rds., and limestone gravel. 12.50 mi. Lincoln Co., sand gravel. 127.337 mi. co. rds.—Bureau Co. Rds., Second Div., Div. Engr., Salina.

Ky., Bowling Green— 2 p. m., June 29
Surfac. 8.5 mi. Bowling Green-Cave City Rd., Warren Co.—State Hwy. Comn., Frankfort.

Ky., Frankfort— 2 p. m., June 15
Grad., drain. surfac. type of constr. 117.5 mi. rds. in 15 cos.—State Hwy. Comn., Division of Constr., Frankfort.

Ky., Frankfort— June 29
Low type surfac. on grade completed last year from Corbin to Cumberland Falls.—State Hwy. Comn., Frankfort.

Ky., Frenchburg— June 15
Constr. Owingsville-Frenchburg Rd.—Kentucky State Hwy. Dept.

Ky., Madisonville— 2 p. m., June 29
Drain. and surfac. U. S. Hwy. No. 41, dist. 7.3 mi.—State Hwy. Dept., Garrett Withers, Hwy. Comr., Frankfort.

Minn., Barnesville— 7:30 p. m., June 10
Constr. of pavmt. curb and gutter on Front St. bet. no. line of First St. and so. line of Market St.—K. A. Borsheim, City Clk., City Council, City Hall.

Minn., Benson— 10 a. m., June 29
Constr. 3 mi. Job 32-S, and 2 mi. Job No. 32-M.—Swift Co.—Leo E. Engleson, Aud. (L. R. Johnson, Co. Hwy. Engr.)

Minn., Fergus Falls— 2 p. m., June 14
Grad. abt. 7 mi. Job 31:05, 32:02, 31:32; and gravel. 11 mi. Job 31:07, 30:32 and 10:32.—Outer Tail Co.—William Lincoln, Co. Aud., Court House.

Minn., Morris— 10 a. m., June 15
Gravel. trunk hwys. Nos. 6, 10, 28, and another, total 90.9 mi.—C. M. Babcock, Comr. of Hwys, Dist. office of Hwy. Dept. in Morris, Minn.

Minn., St. Paul— 10 a. m., June 14
Grad. 56.60 mi., gravel. 156.50 mi. and shldr. 41.70 mi. var. state projs.—C. M. Babcock, Comr., State Hwy. Dept., 1246 University Ave., St. Paul.

Minn., Shakopee— 11 a. m., June 14
Gravel. 8.80 mi., also light regravel. and gravel. on abt. 140 mi. State Aid Rds., grad. 3.80 mi.—C. A. Rds.—Bd. Co. Commrs., Scott Co., Thos. H. Walsh, Co. Aud., Court House.

N. J., Trenton— 12 M, June 13
Constr. 5.391 mi. Rte. No. 42, Sect. 8, 1A and 2A, Gloucester Co.—State Hwy. Comn., A. Lee Grover, Chief Clk., State House Annex, Trenton.

N. J., Trenton— 11 a. m., June 21
Constr. of Rte. No. 42, Sect. No. 7, Grenlock to Woods Corner, Camden and Gloucester Cos.—State Hwy. Comn., A. Lee Grover, Chf. Clk., State House Annex.

To be of value this matter must be printed in the number immediately following its receipt, which makes it impossible for us to verify it all. Our sources of information are believed to be reliable, but we cannot guarantee the correctness of all items. Parties in charge of proposed work are requested to send us information regarding it as soon as possible, also corrections of any errors discovered.

N. D., Fargo— 10 a. m., June 20
Pav. in Dist. No. 222-32, with warrenite bit., vit. brk., port. cem. conc. and "Armorplated" conc. upon conc. fdn.; and Dist. 223-32.—C. O. Jorgenson, Aud., City Hall.

N. D., New Rockford— 2 p. m., June 11
Gravel. rd.—O. F. L. Sundberg, Clk., New Rockford.

O., Bowling Green— 2 p. m., June 10
4 in. waterbound mac. surfac. treat. top course reconstr. and repair. Co. Rd. No. 55, Sec. "H," dist. of 2 mi.; and surfac. treat. No. 1-B-B in Grand Rapids Twp., etc.—Co. Comrs., C. O. Cummings, Aud., Court House. (Orton J. Jones, Co. Engr.)

O., Dayton— 10 a. m., June 9
Oil. sts., 400,000 sq. yds.—Co. Comrs., F. A. Kilmer, Clk. (W. O. Pease, Co. Engr.)

O., Miamisburg— 6 p. m., June 9
Surfac. treat. Eagle (Alexandersville) Rd.—Miami Twp. Trustees, F. E. Treon, Clk., Miamisburg.

O., Napoleon— 10 a. m., June 14
Surfac. treat. 48.10 mi.—Co. Comrs., Lester A. McClure, Auditor. (C. F. Kelley, Co. Engr.)

O., Newark— 12 M, June 9
Grad. and landscaping, Licking Co., Tuberculosis Hospital Grounds.—J. B. Williams, Clk., Co. Comrs.

O., Ravenna— 12 M, June 13
Granulated slag, gravel. surfac. Rd. Nos. 178, 179, 180, Charlestown Twp.; and Rd. No. 47, Rootstown-Edinburg Twp.; Rd. Nos. 195 and 155, Streetsboro Twp.—Co. Comrs., H. L. Hubbell, Co. Engr.

Pa., Erie— June 10
Conc. pav. in rear of new fire headquarters bldg. in W. 12th St., also for sidewalks on e. side of bids, with proper drains.—City Council, City Hall, Erie, Pa.

Pa., Harrisburg— 10 a. m., June 16
Constr. 46,535 lin. ft. rdway. consist. of one course reinf. conc. pav., drainage. 1 rein. conc. arch br., etc.—Pa. Dept. of Hwys., S. S. Lewis, Secy., Room 506 No. Office Bldg., State Capitol.

Pa., Harrisburg— 10 a. m., June 16
One course rein. conc., native stone base course, with bit. surfac. treat. mac. surfac. course, rein. conc., pav., etc. on var. rds. Beaver, Columbia, Allegheny, Dauphin, Northumberland, Luzerne, Venango Cos.—Commonwealth of Pa., Dept. of Hwys., S. S. Lewis, Secy., Room 506, North Office Bldg., State Capitol.

Pa., Harrisburg— 10 a. m., June 17
Rein. conc., grad., modified broken stone or native stone base course with bit. surfac. treat. mac. surfac., pav. rds. in Clarion, Centre, Schuylkill, Somerset, Tioga, Lycoming, Washington, Greene Cos.—Commonwealth of Pa., Dept. of Hwys., S. S. Lewis, Secy., Room 506, North Office Bldg., State Capitol.

Tenn., Nashville— June 10
Pav. 8.696 mi. Hwy. No. 34, bet. Johnson City and Bluff City, Washington-Sullivan Cos.—State Dept. of Hwys., and Pub. Wks., R. H. Baker, Commr., Nashville.

Tenn., Nashville— June 10
Pav. 18.20 mi. hwys. in Wilson, Gibson Cos.—State Dept. Hwys. and Pub. Wks., Nashville.

Tenn., Nashville— June 17
Grad., drain. .7 mi. Sevier Co., surfac. treat. 46.00 mi. Grundy, Summer, Macon, Claiborne, Roane and Morgan Cos.—Dept. of Hwys. and Pub. Wks.

Wis., Milwaukee— 2 p. m., June 9
Conc. pav. and widen. 9.31 mi. 6 rds., Milwaukee Co.; est. cost $249,000.—Wm. F. Cavanaugh, Co. Hwy. Commr., N. end of 3rd Flr. new Court House.

Wis., Madison— 10 a. m., June 10
Constr. Bain and Truesdell grade separation approaches, Kenosha Co. and conc. pav. 10.56 mi. Plymouth-W. Co. Line Rd., Sheboygan Co.—Wisconsin Hwy. Comn.

Sewerage and Sanitation

Md., Baltimore— June 15
Constr. incinerator plant nr. Brooklyn (Miles' Flats) Balto.—Dept. of Pub. Wks., Bureau of Mechanical Electric Service, W. Raynor Straus.

Mo., St. Louis— June 21
Constr. A-6, Maline Creek Public Sew., Letting No. 4445, for improv. Cold Water Creek Diversion Channel from Sta. 36x10 to Sta. 57x10 at St. Louis Municipal Airport.—Bd. of Public Service, St. Louis.

N. Y., Boro. Bronx— 11 a. m., June 9
Constr. sews. and appurts. in Fish Ave., Compton Ave., Stephens Ave., Kingsland Ave., etc.—Henry Bruckner, Pres., Municipal Bldg., Crotona Park, Tremont and 3rd Aves., Bronx.

O., Lima— 12 M, June 9
Constr. sewage sys. for Distr. Tuberculosis Hospital.—Trustees of Dist. Tuberculosis Hospital, Charles Herbst, Pres., & S. M. Williams, Secy.

Pa., Erie— June 10
Constr. 48 in. conc. storm sew., 65 ft. long in vicinity of 6th and Poplar Sts.—City Council.

Pa., Johnstown— 9 a. m., June 9
Constr. sani. sews. Contracts No. 3201 to 3214 inclusive.—Geo. W. Griffith, Dir. of Sts. and Public Improvmts., City Hall.

Wis., Whitehall— 7:30 p. m., June 13
Constr. sew. and water extens. (date EXTENDED FROM MAY 16).—A. W. Wright, Clk.

Water Supply

N. D., Wahpeton— 8 p. m., June 15
Constr. furn. erect. and complet. steel water storage reservoir.—City Council, A. H. Miller, City Aud., Council Chambers.

O., Lima— 12 M, June 10
Constr. underground sprinkling sys. to cover 20 acres of ground., Municipal Sew. Disposal Plant.—Fred C. Becker, City Mgr. (H. P. Jones Engrg. Co., Engr., 2nd Natl. Bank Bldg., Toledo, O.)

S. D., Yankton— June 13
Lay. pipe which runs from pump house to pres. pump on br. pier; also new drains, at waterworks plant.—John W. Summers, Aud., City Hall.

Wis., Whitehall— 7:30 p. m., June 13
Water extens. (Extended from May 16).—A. W. Wright, Clk., City Hall. C. J. Van Tassel, Engr., Whitehall.)

Bridges

Ill., Springfield— 10 a. m., June 15
Constr. rein. conc. substruct., steel superstruct., rein. conc. girder brs., rein. conc. culvts., etc., in var. cos.—Dept. Pub. Wks. and Bldgs., Div. of Hwys., Harry H. Cleaveland, Dir. (Frank T. Sheets, Chief Hwy. Engr.)

Ind., Indianapolis— 10 a. m., June 14
Constr. 34 brs., rein. conc. girder, rein. conc. slab., rein. conc. arch, open spandrel, I-beams, steel truss, etc., in var. cos.—Indiana State Hwy. Comn., Div. of Constr. Br., J. J. Brown, Dir., State House Annex.

Ia., Clinton— 2 p. m., June 9
Constr. 2 steel pony trusses on conc. abutmts. and raising 2 other permanent

steel bridges, Clinton Co.—Auditor, Court House.

Minn., Chaska— June 13
For constr. several conc. bridges; and culvts. on Job 3201, 3202, Carver Co.—Wm. Schlimelpfenig, Aud., Court House.

Minn., St. Paul— 10 a. m., June 14
Constr. portable and mono. culvts. on var. State Projs.—C. M. Babcock, Comr. Hwys., State Hwy. Dept., 1246 University Ave., St. Paul.

N. J., Trenton— 11 a. m., June 13
Constr. viaduct to carry Rte. 29, Sec. 10C across Waverly Yards, 1,300 ft. of plate girder spans, Essex Co.—State Hwy. Comn., A. Lee Grover, Chf. Clk., State House Annex.

N. Y., Boro. Bronx— 11 a. m., June 9
Constr. 3 ft. 6 in. diam. reinf. conc. pipe culvts. across White Pains Rd., So. of Seward Ave. at Pugsley's Creek.—Henry Bruckner, Pres., Municipal Bldg., Crotona Pk., Tremont and 3rd Aves., Bronx.

N. D., Ellendale— 2 p. m., June 15
Constr. box culvts. and bridges. Dickey Co.—C. P. Jenkins, Aud., Court House.

O., Cincinnati— 12 M., June 24
Constr. bridge and approaches Br. No. 63 on Lawrenceburg-Harrison Rd., Harrison Twp. Co. Comrs., L. J. Dreihs, Clerk. (E. A. Gast, Co. Engr.)

O., Columbus— 10 a. m., June 22
Constr. culvt. No. 191 on Michel Rd. No. 25.—Co. Comrs., Fred. L. Donnally, Clk. (Curtis C. Lattimer, Co. Engr.)

O., Findlay— 1:15 p. m., June 9
Constr. 3 bridges, Biglock Twp., Washington Twp., and Delaware Twp.—Co. Comrs., Gale B. Clymer, Clk. (A. P. MacGregor, Co. Engr.)

O., Troy— July 1
Constr. Retter Br., Pansing Br., Dupoy, Weaver, Sproat, Roosevelt, Dugan and Casstown Cemetery Brs.—Co. Comrs., E. H. Bagford, Co. Engr.

O., Wakeman— 1:30 p. m., June 27
Constr. steel superstruct. Br. L-291-208, West Clarksfield Vill.—Co. Comrs., A. S. Vail, Clk. (C. T. Williams, Co. Engr., Norwalk.)

Pa., Harrisburg— 10 a. m., June 16
Constr. bridges, in var. cos.—Commonwealth of Pa., Dept. of Hwys., Room 506, North Office Bldg., State Capitol, S. S. Lewis, Secy.

Pa., Harrisburg— 10 a. m., June 17
Constr. var. types brs. in numerous counties.—Dept. of Hwys., S. S. Lewis, Secy., Room 506, North Office Bldg., State Capitol.

Tex., Austin— June 10
Constr. bridges in Calhoun, Caldwell, Coke, Hempill, Concho, Menard, Crockett, Bell, McLenna Cos., and six conc. multiple box culvts. in Pecos Co.—State Hwy. Comsn., Gibb Gilchrist, Engr., Austin.

Drainage and Irrigation

Ala., Montgomery— 2 p. m., June 28
Furn. all labor and matl. and dredg. Pensacola-Mobile Intracoastal Waterway from mouth of Portage Creek, Ala., to 11 ft. hydrographic contour in Bon Secours Bay, Fla.—War Dept., U. S. Engr. Office, 904 Bell Bldg., Montgomery.

D. C., Washington— 2 p. m., June 29
Constr. 12 mi. open drains, and drainage structs. on Greenfields Div., Sun River Proj., Mont.—Bureau of Reclamation, Fairfield, Mont.

Ill., Chicago— 10 a. m., June 23
Furn. labor and matls. for excav. and dredg. 72,000 cu. yds. earth from upper and lower approaches to Lockport Lock and removal 117 ft. steel sheet piling and its timber bracing from upper entrance to lock.—War Dept., U. S. Engr. Office, first Chicago Dist., 333 N. Michigan Ave., Room 1325, Chicago.

Mich., Detroit— 11 a. m., June 17
Dredg. 1,376,400 cu. yds. of matl. from Courses 2 and 3, Little Rapids Channel, St. Mary's River, Mich.—U. S. Engr. Office, Detroit.

Minn., Aitkin— 1 p. m., June 13
Clean. ditch on town rd. bet. secs. 10 and 11 in town of Aitkin.—Frank Dotzler, Clk., Rte. No. 3, Aitkin.

O., Cincinnati— 11 a. m., June 28
Dredg. 168,245 cu. yds. Vevay Bar, miles 537 and 538 below Pittsburgh, Pa.; and 192,000 cu. yds. Rising Sun Bar, in miles 505 and 506 below Pittsburgh, Pa., in Ohio River.—War Dept., U. S. Engr. Office, 408 Custom House, Cincinnati.

Miscellaneous

D. C., Washington— 2 p. m., June 14
Constr. wharf, with approach, etc., at U. S. Coast Guard Academy, Ft. Trumbull, New London, Conn.—U. S. Coast Guard, Washington, D. C. L. C. Covell, Capt. U. S. Coast Guard, Act. Commandant.

Ill., Chicago— 10 a. m., June 10
Furn. all labor and matls. for constr. head gate alterations and appurtenant wk. at Brandon Road Dam on the Des Plaines River.—War Dept., U. S. Engr. Office, 333 N. Michigan Ave., Room 1325, Chicago. (Dan I. Sultan, Lt. Col., Corps. of Engrs., Dist. Engr.)

La., Baton Rouge— 12 M., June 17
Constr. 21,000 ft. Red River-Bayou Pierre Levee and Drain. Dis., Red River Parish, W. Bank of River, Harmon New Levee.—Board of State Engrs., 207 New Orleans Court Bldg., New Orleans, La.

La., New Orleans— June 20
Constr. 2,875,000 cu. yds. earth work. Second New Orleans Dist.—U. S. Engr's. Office, Prytania St., New Orleans. (Col. J. N. Hodges, Dist. Engr.)

La., New Orleans— June 21
Furn. all labor and matls. and constr. Vermilion Lock, Vermilion Parish.—U. S. Engr. Office, First New Orleans Dist., Poland and Dauphine Sts., New Orleans.

Md., Baltimore— June 14
Constr. steel sheet piling bulkhead abt. 470 ft. long along Patuxent River at Solomon's Island, Calvert Co.—State Roads Comn., G. Clinton Uhl, Chmn., Federal Reserve Bank Bldg., Balto.

Mass., Boston— 12 M., June 15
Furn. all labor and matl. and const. repairs to seawall at Gallops Island, Boston Harbor, Mass.—War Dept., U. S. Engr. Office, 13th Flr., Customhouse, Boston.

O., Cleveland— 12 M., June 23
Property improvmts. for James Ford Rhodes, John Marshall and New South High Schools, includ., surfac., sews., sprinklers, drinking fountains, some conc. and masonry and stone walks.—Board of Education, J. F. Brown, Comr. of Housing, Frank Hogan, Dir.

Tenn., Memphis— 2 p. m., June 9
Constr. 47,200 lin. ft. permeable pile dike wk. on Mississippi Riv. bet. Cairo, Ill., and mouth of White River, Ark.—U. S. Engr. Office, P. O. Box 97.

Official Advertising

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m., advanced standard time, which is twelve o'clock noon eastern standard time, on Wednesday, June 8, 1932, for the construction of highways in the following counties:

County	Deposit Required
ALLEGANY (Concrete: 6.44 miles)	$18,000.00
COLUMBIA (Concrete: 5.31 miles)	15,000.00
GREENE (Concrete: 4.80 miles)	10,000.00

Also for the reconstruction of the following:

ERIE (24 ft. slab, 45 ft. I-beam; Twin 20 ft. slab bridges; Bit. Mac. Mixing Method Optional & Grading shoulders: 0.23 mile)	$ 2,100.00
GREENE (Cons. & Recons.) (Concrete: 6.01 miles)	29,000.00
MONROE (42 ft. I-beam Bridge, no approach: 0.01 mile)	800.00
ORANGE (Concrete & Bit. Mac. Optional: 0.46 mile)	2,000.00
ST. LAWRENCE (30 ft. I-beam bridge, Bit. Mac. Mixing Method, Optional approach: 0.15 mile)	900.00

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and the counties in each district will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

A. W. BRANDT,
Commissioner of Highways.

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m., advanced standard time, which is twelve o'clock noon eastern standard time, on Tuesday, June 14, 1932, for the construction of highways and bridges in the following counties:

County	Deposit Required
FULTON (Concrete: 5.78 miles)	$14,000.00
LEWIS (Concrete: 3.52 miles)	9,000.00
NASSAU & SUFFOLK (Concrete: 2.95 miles)	19,000.00
QUEENS (Grading & Structures: 0.39 mile)	9,000.00

Also for the reconstruction of the following:

BROOME (Bit. Mac. Pen. Method: 0.61 mile)	$2,500.00
CAYUGA & SENECA (125 ft. Truss; 2-90 ft. Girders; Concrete & Bit. Mac. M. M. Type 3 or 5: 0.67 mile)	9,000.00
ESSEX (45 ft. I-beam bridge, Bit. Mac. M. M. type 3 appr.: 0.25 mile)	1,500.00

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and the counties in each district will be furnished upon request.

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A. W. BRANDT,
Commissioner of Highways.

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m., advanced standard time, which is twelve o'clock noon eastern standard time, on Tuesday, June 21, 1932, for the construction of highways in the following counties:

County	Deposit Required
CLINTON (Completion) (Grading & Struct.: 12.23 miles)	$10,000.00
HERKIMER (Cons. & Recons.) (Gravel: 3.50 miles)	6,000.00
JEFFERSON (Concrete: 6.54 miles)	16,000.00
SARATOGA (Grade Crossing) Bit. Mac. M. M. Type 4 or 5; 0.53 mile)	1,100.00
WASHINGTON (Bit. Mac. M. M. Type 3: 10.06 miles)	20,000.00
WASHINGTON (Gravel—Concrete: 0.15 mile)	5,000.00

Also for the reconstruction of the following:

NIAGARA (Bit. Mac. M. M. Type 3: 3.89 miles)	$16,000.00
TOMPKINS & CAYUGA (Bit. Mac. M. M. Opt.: 0.47 mile)	2,000.00

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and the counties in each district will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

A. W. BRANDT,
Commissioner of Highways.

Ammonia-Chlorine and Activated Carbon Treatment of Water

Conclusions from investigations. Supplementing article in the May issue.

H. H. GERSTEIN, sanitary engineer of the Department of Public Works, Chicago, reported the following conclusions from investigations made by that city in ammonia-chlorine treatment of Lake Michigan water having a pH of 7.8 to 8.0. (Enslow says that "results at pH values below 7.0 should show the process in a much more favorable light.")

1. The treatment is effective in preventing the formation of the chlorinous and chlorophenol tastes and odors which are associated with the chlorination of water supplies, and in addition is very efficient bactericidally where adequate contact is available.

2. For the same chlorine dosage the bactericidal velocity of ammonia-chlorine treatment is decidedly less during the first two hours after the treatment is applied than that obtained with chlorine alone. The larger the amount of ammonia present, the greater the lag in bactericidal effect.

3. For periods of contact longer than two hours, the bactericidal effect of ammonia-chlorine treatment is greater than that obtained by the use of the same amount of chlorine alone. In this period the ultimate effect is greater with a larger amount of ammonia present.

4. By increasing the ratio of chlorine to ammonia it is possible to obtain a combination which will equal the bactericidal velocity attained after a five-minute contact when using chlorine without ammonia. This ratio of chlorine to ammonia, however, did not prevent the formation of chlorophenol tastes and odors in the Chicago water.

5. The temperature of the water has a marked effect on the bactericidal efficiency of the treatment, the efficiency decreasing with lowering of temperature within the range of the experimental work, 20° to 0°C.

6. An increase in the turbidity of the water naturally decreases the bactericidal efficiency of the ammonia-chlorine process.

W. C. Lawrence, superintendent of filtration, Baldwin filtration plant, Cleveland, reported that the treatment there gave the following results:

1. No chlorophenolic or chlorinous tastes and odors have been noticed since the adoption of the ammonia-chlorine process.

2. Highly satisfactory sterilization with apparently no delay has been obtained at both plant effluents and throughout the distribution system.

3. Due to the maintenance of at least 0.1 p.p.m. of chlorine residuals throughout the distribution system, aftergrowths and algae have been entirely eliminated, even after the water passes through the two open reservoirs. .

4. No increase in the amount of chlorine previously applied was necessary when ammonia was added to produce as good a bacterial effect as when chlorine was used alone.

E. C. Goehring, superintendent of filtration of the Beaver Valley Water Co., drew the following conclusions from the use of this process at two of its plants:

1. The ammonia-treated water was far more palatable.

2. Eearthy, musty and fishy tastes and odors were entirely eliminated with the ammonia treatment; while the plant operating without ammonia produced water which had these tastes present.

3. Residual chlorine tests were found in all parts of the system using ammonia-treated water; whereas in the other system no residuals could be found except close to the plant.

4. Aftergrowths in the reservoirs on the ammonia-treated water system were absent; while in the other reservoirs with the normally treated water, occasional aftergrowths were found. The same applied to algae growths in the reservoirs of the two systems, none being found in the ammonia-treated water.

5. With the equal chlorine dosages, higher residual chlorine values could be maintained in the ammonia-treated system without the formation of chlorinous tastes and odors. In the other system, it was necessary to maintain a residual within a much narrower range in order to prevent appearance of chlorinous tastes and odors.

6. In the ammonia-treated water it was found necessary to allow a longer contact time for complete sterilization before the water left the plant. With two hours available contact time in the clear well it was found necessary to carry 0.20 p.p.m. residual chlorine in order to completely sterilize the water in this period. The contact period required varied with the amounts of ammonia used; i.e., the more ammonia for the same chlorine, the slower the sterilization. The time for complete sterilization also varied with the pH of the water; i.e., the higher pH value, the slower the sterilization rate. In the other plant, with chlorine alone, 15 minutes was sufficient to sterilize the water with the same chlorine dosage.

7. By applying the ammonia-chlorine treatment to the raw water, algae conditions, which developed on the filters and sedimentatioin basin walls, were completely removed and controlled without taste formation. At the other plant without ammonia, prechlorination of the raw water was equally effective in removing algae, but with a slightly higher chlorine consumption. The production of taste from the algae oils was at times noticeable, however.

8. No exact ratio of chlorine to ammonia is applicable under all raw water conditions. Ratios of chlorine to ammonia had to be changed from as low as 1 Cl. to 0.3 NH_3 to as high as 1 Cl. to 1 NH_3 to gain the desired results.

9. A rather unusual observation made during this period on the two distribution systems brought out the fact that the ammonia-treated water assisted in removing crenothrix growths in the pipe lines. After a few months operation, hydrant flushings required longer runs to clear the lines, but after several flushings, a much shorter run was necessary to clear the water. In the other system, no change in hydrant flushing was noticed.

10. It was found best to apply the ammonia and chlorine to the raw water, the ammonia first, and, as soon as thorough mix had been obtained, to add the chlorine.

Berliner and Howe state that "Even the most rabid partisans of the ammonia-chlorine treatment make no claim that chloramine will prevent all tastes and odors. It has proved effective against those caused by algae, by phenols and by high chlorination. It has not been effective against those identified as stale, mouldy, swampy, flat, etc. It seems to be particularly effective against those tastes and odors which are made very offensive when they combine with chlorine."

Concerning destruction of algae growths they say: It is almost impossible to say which algae the chloramine will kill and which it will not . . . Whatever algae can be curbed or reduced by chlorine alone will be killed and removed by chloramine. It may be that the process would take a longer time with chloramine, but it would eventually be more complete. In general we can say that chloramine will be effective against most of the common algae and biologic slimes. Unless the residual is greatly increased over normal, the cleansing action will be gradual and sure. The system will be cleansed from the point of application to the far ends of the distribution "lay-out" and aftergrowth and further growth will be prevented.

After 2½ months of close observation of the carbon treatment at the Norfolk, Va., plant, R. W. Fitzgerald has drawn the following conclusions:

1—Tastes and odors can be economically controlled by the use of powdered activated carbon.

2—Sludge can be stabilized as shown by the doubling of the periods between basin cleanings. The cost of the water thus saved is an important economic factor in plant operation.

3—The use of ammonia has been found unnecessary when carbon is applied and has been discontinued.

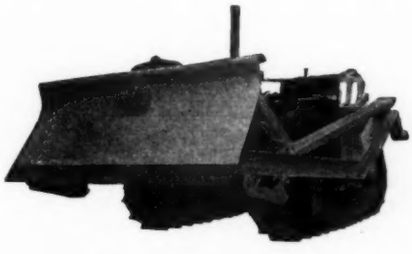
4—Accurate tests have shown that the carbon particles have not penetrated the filter beds to a depth of more than 10 inches.

5—Shortening of runs has been a negligible factor.

Dirt-Moving and Construction Equipment

A New High Lift Bulldozer

The LaPlant-Choate Manufacturing Co., Cedar Rapids, Ia. has incorporated the following features in their new Hy-lift Bulldozer: An extra high lift which enables the blade to be raised 33 inches above the ground level. A' new main frame design and high lift mechanism at the rear of the tractor, which allows the blade to drop 18 inches below track ground line. A double acting jack which forces the blade into the ground or raises it quickly in the hardest going. A unit with the blade and jack built compactly to the tractor to facilitate its use in close quarters. A design which leaves the tractor drawbar entirely in the clear, so that it may be used for hauling wagons or other equipment without removing the Bulldozer. A complete ground clearance when the blade is raised prevents the unit from "high-centering" on the Bulldozer main frame.

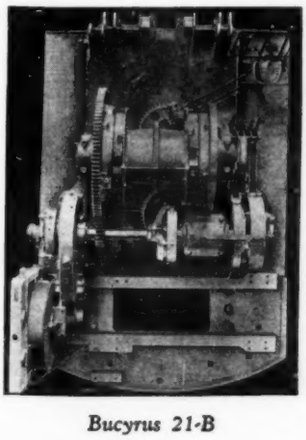


LaPlant-Choate High-Lift

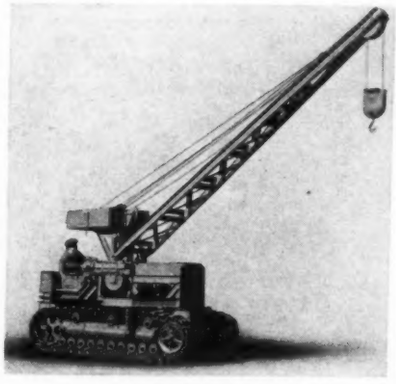
A New 3/4-Yard Bucyrus-Erie

Another new machine recently put in production by Bucyrus-Erie Company is the 21-B, 3/4-yard gasoline, Diesel or electric, convertible shovel-dragline-crane-clamshell. Many features have been included to make it easier for the operator to turn out maximum yardage every day. A power dipper-trip saves him energy and cuts dumping time; oversize clutches and brakes give effortless and accurate control; hoist clutches are power set; all operating levers toggle in. The double-operating chocking brakes are applied from the operator's stand; a swing brake is provided for operating on a grade; the direction of the operating levers can be easily changed to suit the individual operator. When moving, the machine is steered from the operator's stand with the cab in any position.

Complete information regarding this new excavator may be obtained by writing Bucyrus-Erie Company, South Milwaukee, Wisconsin.



Bucyrus 21-B

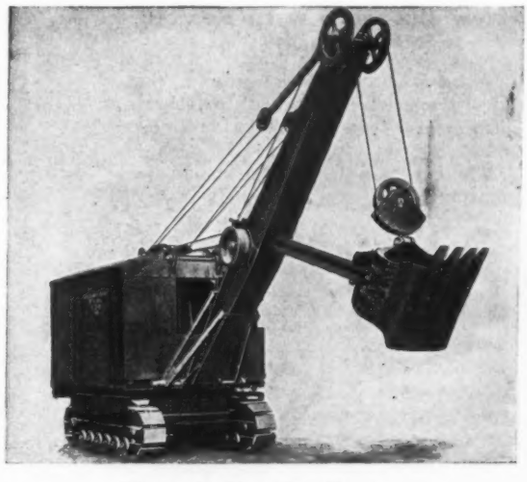


Cletrac Equipped Full Revolving Hydraulic Crane

New Marion 1/2-Yd. Gas Shovel

The Marion Steam Shovel Company, Marion, Ohio, announces a new 1/2-yd. shovel, dragline, clamshell and crane, named "Type 120." This is a gas machine designed for small general excavating and material handling work. It incorporates a number of unique features, including a rotating gear as large as the overall width of the crawlers, centralized machinery mounting, ballbearing roller path, and high ground clearance combined with unusual compactness.

If you want fuller descriptions of the equipment mentioned here or on other pages, write: Equipment Department, Public Works, 310 E. 45th St., N. Y.



Marion 1/2-Yard Gas Shovel

Hydraulic Full Revolving Crane

This full revolving crane mounted on the long, wide Cletrac 35 Equipment Special is a unit of unusual capacity and mobility. It is a full revolving crane with a maximum capacity of 7,500 pounds at a 10-foot radius and 3,500 pounds at a 20-foot radius in any direction with a 21-foot boom. It is easily maneuvered and mobile. It has no clutches or brakes to wear and produce trouble. All moving parts are enclosed and operate in oil. It has only two hand controls—one for operating the raising and lowering motor and one for operating the slewing motor.

Koehring Brings Out New Wheel Dumptor

Designed for use on dirt-hauling jobs where tractive ground conditions permit the use of wheels, the Koehring Wheel Dumptor provides low cost, dependable high speed transportation. Built by the Koehring Division of the National Equipment Corporation of Milwaukee, Wis., it has a load-carrying capacity of 4 cubic yards. Exceptional performance of this machine is made possible by combining a relatively small load on large tires with excess motor power, by providing a short wheelbase, and by the advantages of instantaneous front gravity dump and spreading type body.

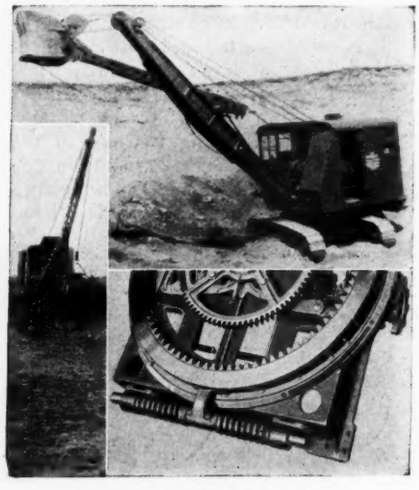
4-Yard Dumptor

Designed to meet 1932 dirt-moving prices, this machine has unique advantages, including: Three speeds forward and three speeds reverse. Allow shuttling on most hauls; with the high re-

verse speeds, it eliminates turns and saves many seconds each trip; 18 to 20 seconds saved on each dump; dumping angle 90 degrees; automatic kickout pan insures clean dump; exceptionally short turning radius, accomplished by the 85¼ inch wheelbase making it possible to turn in a 26-foot circle; wheel equipment is interchangeable from the pneumatic lug type tractor tires to 24 inch steel wheels equipped with two rows of spad lugs.

Buckeye 7-16 Yd. Convertible Shovel

A new 7/16-yard Buckeye Convertible Shovel has just been announced by The Buckeye Traction Ditcher Company, Findlay, Ohio—a new shovel that is big enough to handle most any job where a ½-yard shovel would be needed, yet having the nimbleness and ease of handling characteristic of a ⅜-yard machine.



Views of the Buckeye Shovel

One of the important features of this new shovel is the patented spring-stop shock absorber which entirely eliminates swing clutch slippage and shock to relative parts at the moment of reversing.

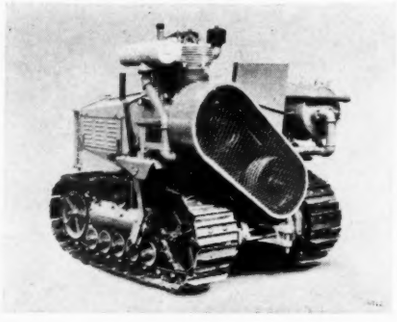
New Bin Gate With Remote Control

A new automatic dump gate that can be opened and closed by electric push release switch has been developed by the Stephens-Adamson Mfg. Co.

The gate was designed primarily for emptying batch weigh hoppers in S-A ready mixed concrete plants, but can be used wherever the entire load in a bin or hopper is to be dumped by remote control.

This new gate is made for openings from 12″x12″ to 18″x24″ and can be operated by push release switch from a control panel at any distance from the hopper.

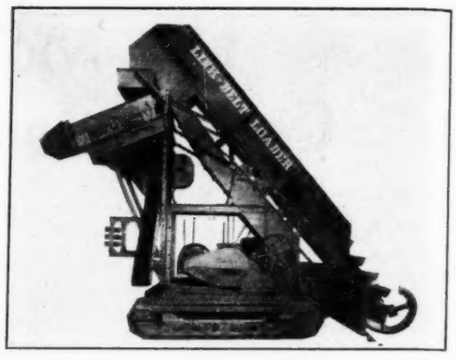
Bin Gate With Remote Control



This Davey Compressor, mounted on the Cletrac "15," provides a flexible combined unit whereby utilization of the compressor is available in very convenient form and does not interfere with the other uses of the tractor for pulling purposes. The compressor unit weighs only 890 pounds.

New Heavy-Duty Vibrating Screens

Two new types of vibrating screens have just been announced by Link-Belt Co., Philadelphia, Pa. These screens are known as the positive-drive-type, heavy-duty vibrating screen, which is made with both single and multiple decks, and the unbalanced-pulley-type, heavy-duty vibrating screen, which is made with single and multiple decks.

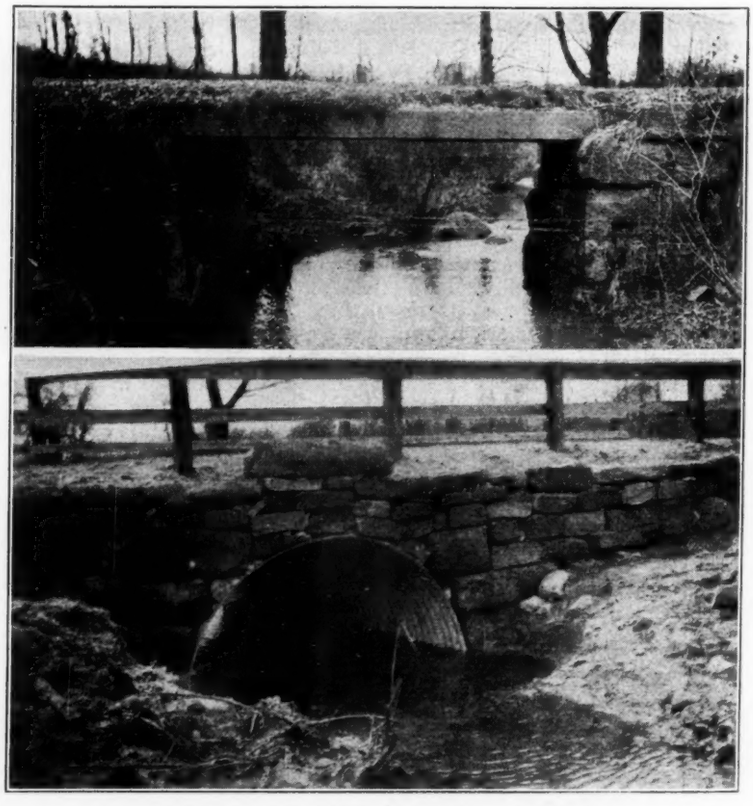


Link Belt Loader and Vibrator

These two additions to the Link-Belt line of vibrating screens are for uses where large screen openings are required and heavy capacities must be handled.

Part-Circle Multi-Plate Pipe

Armco Culvert Mfrs. Ass'n., Middletown, O., has developed a part circle multi-plate pipe for adequate waterway areas where headroom is lacking. This type of pipe is shipped in plates, and bolted together on the job. Spans may range from 90 to 220 inches, with any desired length to the nearest 5 feet. Arch plates are available in 3, 5 or 7-gauge Armco Ingot Iron. The built-up structure has been tested under severe conditions, with no tendency to failure.



Part-Circle Pipe below; above, before installation

American Water Works Association Meeting Most Successful

The 52nd annual convention of the American Water Works Association, which was held at Memphis, Tenn., May 2 to 5, was one of the most successful ever held, though the attendance was somewhat smaller than in past years. The program was an excellent one, well arranged and well carried out, and the papers were good.

A wide range of subjects was covered. Monday afternoon, business sessions opened with the Superintendents' Round Table Discussion, A. F. Porzelius presiding, and with a session of the Water Purification Division, Paul Hansen presiding. Both sessions were well attended. Social events of the day included an informal dance in the evening, and the annual dinner of the "Service des Eaux."

Pumping, deep wells, the Memphis water supply, and new developments in metering and controlling equipment were the subjects covered at the main session Tuesday morning. At the same time, the committee on Boiler Feed Water Supplies was hearing a number of reports. The main session was continued in the afternoon, and at this time the Water Purification Division again swung into action, with John R. Baylis as chairman. At this session there were four papers on filters and one on Zeolite softening.

With this start, the Water Purification Division, and a whole lot of others enjoyed the usual annual dinner under the leadership and excitement of the inimitable Bill Orchard. Even the dinner was good, and the broadcasting ditto. About 250 enjoyed this event.

The main session and the finance and accounting division session held meetings Wednesday forenoon; and in the afternoon the water purification and plant management and operation divisions were in action. Thursday morning there was a joint meeting of the general membership and the water purification division, with Martin Flentje as chairman, while the finance and accounting divisions continued its work also. Thursday afternoon there was a joint session of the general membership and of the finance and accounting division, while on Friday morning the latter division held the final meeting of the convention.

The Diven Memorial medal was awarded to W. W. Brush, and the John M. Goodell prize to John R. Baylis. Awards to exhibits of manufacturers went to Wallace & Tiernan Co., Layne & Bowler Co., and the Dorr Co. in the order named. I. M. Glace of the Pennsylvania Department of Health won the grand prize of $100 for picking the winners, and other prizes went to J. C. Matthews, L. A. Young and C. M. Newkirk.

George W. Pracy, superintendent of the San Francisco water department, was elected president, succeeding Ross L. Dobbin. J. W. Ellms of Cleveland is the chairman of the Water Purification Division, with Harry Jordan as secretary. H. F. Blomquist, superintendent of the Cedar Rapids, Ia., Water Works, is chairman of the Plant Management and Operation Division; and C. J. Alfke of the Hackensack Water Co. is chairman of the Finance and Accounting Division.

The next meeting will be held in Chicago, Ill.

Pennsylvania Water and Sewage Association

The fifth annual conference of the Pennsylvania Water Works Association will be held at State College, Pa., June 20-22, and the meeting of the Sewage Works Association will follow immediately thereafter.

American Road Builders' Association

The annual meeting of the American Road Builders' Association was held in Washington, D. C., on April 28 and 29.

New officers and directors installed at this meeting were:

President: T. H. Cutler, chief engineer, Missouri State Highway Commission, Jefferson City, Mo. *Vice Presidents:* F. L. Benedict, vice-president, National Steel Fabric Co., Pittsburgh, Pa.; J. W. Barnett, chairman, Georgia State Highway Board, Atlanta, Ga.; G. C. Dillman, state highway commissioner of Michigan, Lansing, Mich.; Stanley Abel, supervisor, Fourth District, Kern County, Taft, Calif. *Treasurer:* James H. MacDonald, consulting road and paving expert, New Haven, Conn. *Directors:* J. H. Cranford, president, Cranford Paving Co., Washington, D. C.; A. W. Dean, chief engineer, Massachusetts Department of Public Works, Boston, Mass.; E. J. Harding, managing director, Associated General Contractors of America, Washington, D. C.; J. S. Helm, general manager, Asphalt Sales Department, Standard Oil Company of New Jersey, New York, N. Y.; A. E. Horst, secretary-treasurer, Henry W. Horst Co., Philadelphia, Pa.; G. B. Sowers, Cleveland, Ohio; C. M. Upham, engineer-director, American Road Builders' Association, Washington, D. C.

City Officials' Division

President: R. B. Brooks, director of streets and sewers, St. Louis, Mo. *Vice Presidents:* D. T. Corning, chief, Bureau of Highways, Philadelphia, Pa.; R. Keith Compton, director of public works, Richmond, Va.; R. H. Simpson, chief engineer, Department of Public Service, Columbus, Ohio; J. M. Tippoe, city engineer, Des Moines, Iowa. *Directors:* W. E. A. Doherty, engineer of construction, Bureau of Highways, Philadelphia, Pa.; M. O. Eldridge, assistant director of traffic, Washington, D. C.; O. Laurgaard, city engineer, Portland, Oregon; M. M. O'Shaughnessy, city engineer, San Francisco, Calif.; A. T. Rhodes, city councillor, Leominster, Mass.; W. E. Sheddan, city engineer, Jacksonville, Fla.; N. L. Smith, associate engineer of Baltimore, Md.

County Highway Officials' Division

President: W. O. Washington, county engineer, Cameron County, Brownsville, Tex. *Vice Presidents:* H. B. Keasbey, county engineer, Salem County, N. J.; C. E. Burleson, county engineer, Pinellas County, Clearwater, Fla.; H. G. Sours, county engineer, Summit County, Akron, Ohio; G. W. Jones, county superintendent of highways, Los Angeles County, Los Angeles, Calif. *Directors:* J. T. Bullen, parish engineer, Caddo Parish, Shreveport, La.; J. A. Bromley, county roads engineer, Anne Arundel County, Annapolis, Md.; B. T. Collier, county engineer, Coahoma County, Clarksdale, Miss.; C. W. Deterding, county engineer, Sacramento County, Sacramento, Calif.; Don Heaton, county surveyor, Benton County, Fowler, Ind.; Roy Jablonsky, county surveyor, St. Louis County, Clayton, Mo.; G. C. Wright, county superintendent of highways, Monroe County, Rochester, N. Y.

Fourteen other directors of the Association and also of the Divisions carry over.

Planning the Outdoor Swimming Pool.—Written by Linden J. Murphy, this publication of 40 pages appears as Bulletin No. 108, Engineering Extension Service, Iowa State College, Ames, Ia. While the material in it has been prepared largely for the use of civic leaders who are sponsoring swimming pool projects, considerable data of value and interest to the designing engineer have been included.

Camp Sanitation. — An excellent booklet of 70 pages issued by the New York State Department of Health. It covers location of the camp site, insect control, camp equipment, water supply and purification, swimming pools, sewage and refuse disposal and milk supply. It is well and practically written. There is not much really new in this bulletin, but there is so much sound common sense and knowledge back of it, that it is of considerable reference value.

Straightline Bar Screen.—A new Folder, No. 1287, describing Link-Belt Company's recently announced Straightline Bar Screen, is now being distributed by the company from their Philadelphia, or Chicago offices. This mechanically-cleaned bar screen was designed to protect pumps, fine screens, digestion tanks, etc., as it is important that large floating solids, blocks of wood, twigs, papers, leaves, etc., be removed early in the handling of incoming sewage. To insure continuous removal of accumulating solids, mechanically cleaned bar screens are replacing the old hand cleaned screens, even in the smaller plants. The continuous mechanical removal of this refuse assures an even flow of sewage, and eliminates the peak flows which are so detrimental to the efficiency of any plant which depends upon intermittent hand raking.

Armco Spiral Welded Pipe.—The American Rolling Mill Company has just published an attractive handbook on Armco Spiral Welded Pipe, which contains specific information helpful to the user of specially designed pipe requiring a range of diameters from six to twenty-four inches, and a variety of wall thicknesses. It describes the spiral welding process and the economies to be derived by using this product; It contains size, weight, and pressure tables; it discusses the various types of coatings, couplings, joints, fittings, and flanges; there are also tables for converting pounds pressure per square inch into feet head of water, and vice versa, information on car loadings, and complete specifications for spiral welded pipe. This book contains forty pages.

Industrial Publications

Aluminum Fences.—One of the recent developments in the fence industry has been the adoption of aluminum for the manufacture of woven wire fences. It is meeting with widespread approval by the trade, due to the fact that it is non-corrodible and does not require periodic painting to keep it in perfect condition. Although the initial cost is higher than for fence made from other metals, it is actually lower in cost over a period of years, when all factors are taken into consideration. A booklet entitled "Why Aluminum Fence" outlining the development of aluminum and why it makes a better fence, has recently been issued, and a copy can be secured from the Page Steel & Wire Company, Bridgeport, Conn. This booklet should be in the hands of every person interested in permanent fencing.

Turbo Blowers and Compressors.—Ingersoll-Rand Company, 11 Broadway, New York, has issued Bulletin No. 3132, a 44-page booklet which illustrates and describes its line of turbo-blowers and turbo-compressors. The bulletin covers the construction and operation of single-stage and multi-stage blowers for discharge pressures of one to 40 pounds and capacities of 3,000 to 100,000 cubic feet per minute; and turbo-compressors for discharge pressures up to 110 pounds and capacities of 8,000 to 10,000 cubic feet per minute. The booklet contains 37 illustrations, including sectional drawings, charts, blower parts, and complete units.

Hammer Drills. — Bulletin 87-D, eight pages, Sullivan L-6 Hammer Drills, second edition. This bulletin describes the new improved Sullivan medium weight Rotators for outdoor rock excavation and down hole drilling in mines, quarries, and on construction work. "L-6" drills weigh 64 lbs., capable of drilling from 12 to 25 feet in depth and utilizing 1-inch steel. The machine is equipped with the new type front head, in which a cam and locking bar are employed for retaining the steel in the chuck. This device is simple, rugged, easy to lock or release "L-6" drills are available in hollow piston, air tube and water tube types for various conditions of service.

Welding and Cutting Equipment.—The Bastian-Blessing Company, 240 East Ontario Street, Chicago, announces Rego Catalog No. 57, a pocket size booklet of 40 pages, indexed for ready reference, which lists specifications and prices of all types of welding and cutting torches, regulators, gas economizers, acetylene generators and the various accessories. It fully describes each piece of equipment and lists its uses. Many helpful hints are included. The chapters on "How to Make Up a Special Outfit," "How to Choose a Torch" and "Regulators Make the Outfit" are of especial interest to any one interested in gas welding or cutting.

Motor Truck and Tractor Cabs.—Cabs for motor trucks and tractors are described in a catalog published by the Highland Body Mfg. Co., Cincinnati, O. The advantages of protecting the operator during bad weather are worth considering.

Tractor Cabs.—Protection, all-year comfort, better vision and low cost are secured through the use of cabs on tractors. They are a practical necessity where operation is necessary during all kinds of weather, and a good investment. Ask for folder from Minneapolis Engineering Co., 2938 Pillsbury Ave., S., Minneapolis, Minn.

Austin Leaning Wheel Grader.—The Austin 101 leaning wheel grader is described in Bulletin 1238, published by the Austin-Western Road Machinery Co., Chicago, Ill.

Caterpillar Leaning Wheel Grader.—The Caterpillar Tractor Co., Peoria, Ill., has issued an illustrated folder on the Caterpillar Twenty leaning wheel grader, giving specifications in full.

Caterpillar Elevating Grader.—The "Caterpillar" Sixty Elevating Grader With Engine Belt Drive is described in a broadside issued by the Caterpillar Tractor Co., Peoria, Ill. This pictures the strong points of this great machine that is setting such records on the Mississippi Levees and on many contracting and road building jobs throughout the country. The specifications are also given.

The Consulting Chemist and Your Business.—A booklet recently issued by Foster D. Snell, Inc. The booklet, 6½ x 9½ inches in size, printed on coated paper stock, outlines the nature of the services rendered by that company. Copies will be mailed free upon request to Foster D. Snell, Inc., 130 Clinton Street, Brooklyn, N. Y.

Dual Drive Motor Grader.—Austin-Western Road Machinery Co., Chicago, Ill., has issued a new bulletin describing the Model 77 dual drive motor grader, which has been brought out in an improved form, with greater power and efficiency. Bulletin 1239 may be obtained from PUBLIC WORKS or from the manufacturers.

Sewage Pumps.—A new bulletin on sewage pumps, including non-clogging, screenless pumps for sludge, sewage and detritus has been issued by Yeomans Bros. Co., Chicago, Ill. Dimensions, typical layouts and performance charts are included in this publication. It will be sent on request.

Steel Liner Plates.—A new catalog gives a complete presentation of Truscon steel liner plates for use in permanent underground work, such as sewer and walls, tunnels, caissons and shafts. Truscon Steel Co., Youngstown, O.

Traffic Control.—General Electric traffic control apparatus is described in a bulletin recently issued by the General Electric Co., Schenectady, N. Y.

Oil Burners.—Hauck Mfg. Co., 126-134 Tenth St., Brooklyn, N. Y., manufacture a full line of oil burners and oil burning equipment, including asphalt emulsion sprayers, surface heater, kettles, oil burning torches and weed burners. This equipment is described in a complete catalog, which will be sent on request to PUBLIC WORKS or the manufacturers.

Air Compressors.—O. K. Clutch & Machinery Co., Columbia, Pa., has issued a new catalog on portable air compressors covering a wide range of applicability.

The Paradon Company of Arlington, New Jersey, has reprints available of "The Swimming Pool and Its Operation." This gives a very comprehensive study of swimming pools and forms a valuable reference to those contemplating the construction or operation of a pool. A request addressed to the company or to PUBLIC WORKS will bring a copy of this article.

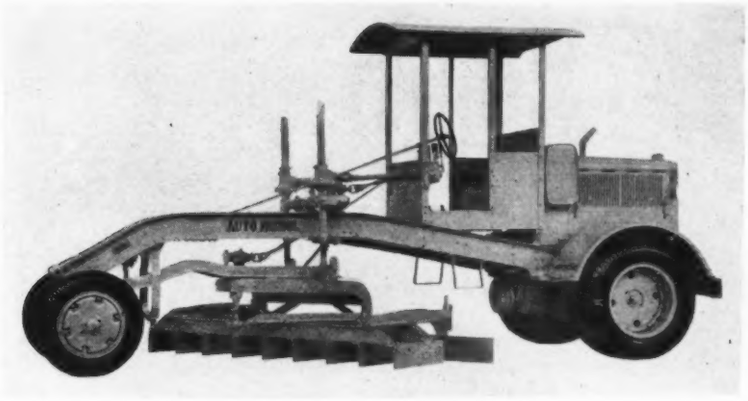
The Linn Manufacturing Corp., Morris, N. Y., manufacturers of the Linn truck tractor have announced price reductions ranging from $1380 to $1625 according to models. The 100 H. P. 6-cylinder Linn, which previously sold for $8005, is now $6380. The 75 H. P. 4-cylinder, formerly $7460 is now $6080. Standard equipment includes wheel or sled steerage, closed cab, electric lights and starter, high speed reverse and rear tipping Linn dump body and hoist with spreader or down fold tail gate.

Mueller Brass Co., Port Huron, Michigan, reports an increase of 296% in their sales of streamline copper pipe and fittings for the fiscal year ending November 28, 1931, as compared with the preceding year. For the 13 periods just ending their sales totaled $448,553.32, in spite of the fact that the building market has shown a decline over this same period and that copper prices are down.

The Barber-Green Company, of Aurora, Illinois, announce the appointment of D. B. Frisbie, veteran Barber-Green salesman, as new branch manager of their Pittsburgh office.

Mr. Frisbie has been with the company since 1918, and was the first salesman taken on after the company organized. He opened the first Barber-Greene branch office, in Cleveland, Ohio. In his long service he has been Eastern Sales Manager with office in New York, Southern Sales Manager with office in Atlanta, and Field Sales Manager, working from Aurora.

Highway Maintenance Equipment



Caterpillar Multiple Blade Maintainer

New Austin Bituminous Distributors

A new line of Bituminous Distributors has been announced by The Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, Ill. These are built in capacities of 600, 800, 1000, 1200 and 1500 gallons to handle all grades of oil, tar, and asphalt, and can be mounted on any standard truck or trailer chassis without altering the chassis cross braces, supports, etc. Any desired uniform quantity of bitumin per square yard may be applied over any specified width.

Austin Distributors for oil, tar and asphalt are made in capacities of 600 to 1500 gals.

Uses of Small Distributors for Maintenance

A small distributor for maintenance work, made by Littleford Bros., Cincinnati, O., has a tank capacity of 75 gallons, sufficient for a patch up to 50 square yards. This unit has rubber tires, a power air compressor and other equipment for doing a complete job. Three of them are in use in Washington, D. C., where they are employed on the folowing types of work: Making adjustments to street ends by penetration methods where the area does not exceed 50 square yards; repairing small areas of broken surface, treating with light or heavy skin patches; putting on non-skid treatments by inverted penetration; and aplying paint coats to holes prior to placing patch material. Further information can be obtained from the manufacturers.

Caterpillar Maintainer Knocks Out the Washboards!

Caterpillar Tractor Co. announces the Multiple Blade Arrangement for auto patrols, which is designed to cover a swath equivalent to that obtained by the use of a standard 12-foot blade. It consists of nine short cutting blades of 8" x ½" cutting edge material 27 inches long mounted on a frame at right angles to a leveling blade of 8"x½" cutting edge material 12 feet long.

Installation on "Caterpillar" Auto Patrols in the field may be accomplished by cutting only two rivets and replacing with bolts which are furnished. If at times it is desirable to use a regular blade for shoulder trimming, or the like, substitution is easily effected.

The short parallel blades in front do the business of eliminating washboards.

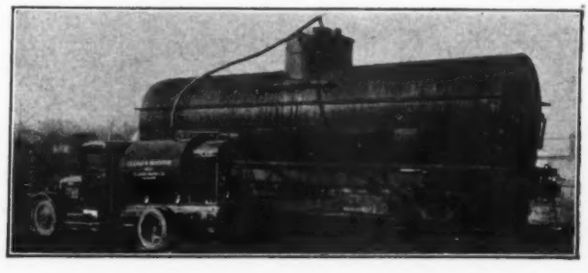
Speeds of 6½ or even 10 miles per hour—without chatter is now permitted. It finishes perfectly and allows more miles to be covered at less cost.

Cleaver Booster for Road Oil Handling

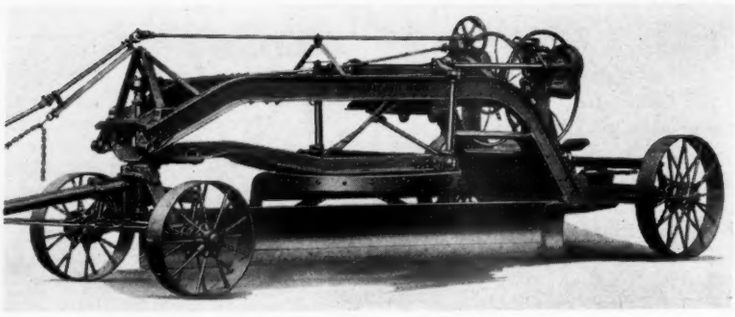
The Cleaver "Booster"—an oil burning, low pressure unit, for heating road oils and other bituminous materials—has been put on the market by the Cleaver-Brooks Co. of Milwaukee, Wis.

A 3-inch line connects the outlet of the tank car to a 3-inch reversible asphalt pump. The material is pumped from the car through the "Booster" and either back into the car through the dome, or directly into distributors or transfer tanks. The illustration shows this unit heating a 10,000 gallon car of Tarmac T. 50 degrees per hour, pumping the material at 165 gallons per minute.

A wide range of pumping and heating speeds are provided on Cleaver "Boosters" which are mounted on two wheel trailers or on 1½-ton trucks.



Left: Littleford small distributor. Right: The Cleaver Tank Car Heater



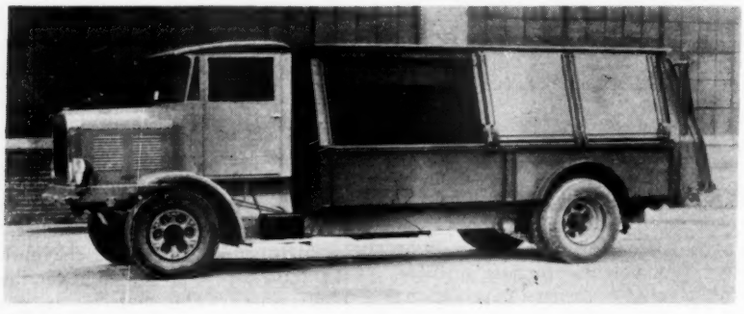
Caterpillar Grades for the "Fifty" Tractor

New Caterpillar Grader

A new grader of the leaning-wheel type for use with the Caterpillar Fifty tractor has been brought out by the Caterpillar Tractor Co., Peoria, Ill. This grader has a 12-foot blade with flexibility that allows bank cutting 9 feet high at an angle of 20 degrees off perpendicular, and a blade range that gives a side reach of 62 inches outside of rear wheels for shoulder work, when the standard blade is set at a 45 degree horizontal angle. A still greater reach is possible by the use of blade extensions.

A New Low Bed Truck by FWD.

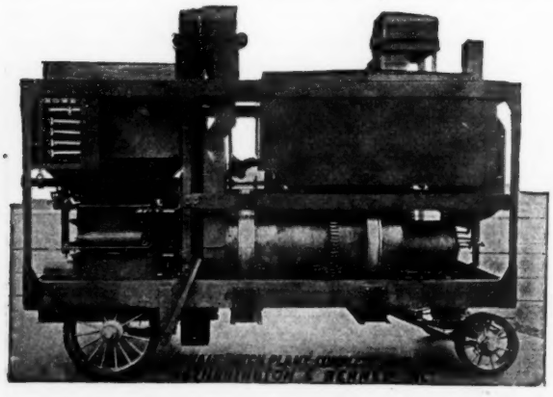
A new low-bed, 5-ton four-wheel-drive truck with a frame height of 21 inches has been put in production by the Four Wheel Drive Auto Company of Clintonville, Wisconsin. This truck, designated as the LBU model, is powered by a 91-horsepower high compression motor, and is equipped with two sets of brakes. This new FWD low-bed is especially adaptable to specialized hauling applications where hand-loading or unloading is necessary; where the loads are bulky or the commodities fragile. In refuse collection work this model carries bodies of 10 to 20-yard capacity and of many different types. Individual rack bodies for special materials are also available. Complete information will be sent on request to the manufacturer or to this magazine.



Low-Bed FWD Truck is adaptable to many uses and is especially valuable on refuse collection

Portable Automatic Asphalt Patch Plant

Hetherington & Berner, Inc., Indianapolis, Ind., have developed a portable automatic asphalt patch plant which has a capacity up to 400 yards per day. It will mix black base, binder or top material and can also be used for cold mix. It operates with fuel oil. Bulletin R-400 describes this plant.



Hetherington & Berner one-unit patch plant

I-R Shank Grinder

Ingersoll-Rand Co., 11 Broadway, New York, announces a shank grinder for facing the striking ends of drill steel shanks, rock drill and paving breaker pistons, and anvil blocks.

Its use insures the uniform and correct dressing of striking faces and eliminates rounded drill steel shank ends and cupped pistons, which are responsible for much of the spalling and breaking of these parts.

Automatic Roll-Over Scrapers

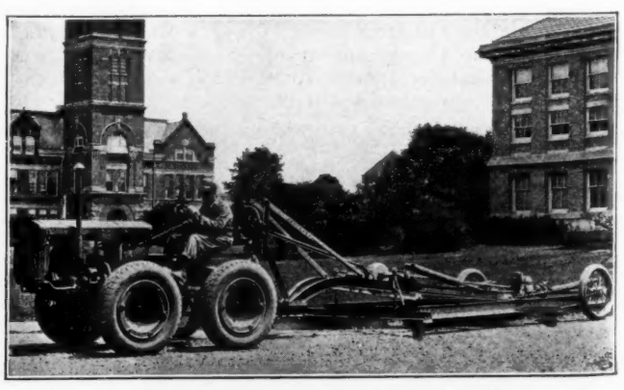
LaPlant-Choate automatic roll-over scrapers are built in five sizes with the following capacities: 18, 22, 27, 42 and 56-cubic foot, for use with tractors from 15 to 65 horsepower.

LaPlant-Choate Roll-Over Scraper

These one-man scrapers have a simple tripping mechanism that allows the scraper to be tripped while going forward or backward, and are equipped with a self-cleaning latch. They can be used to good advantage in the construction of drainage ditches, excavation work, bank widening, cleaning waterways, leveling and on short haul work, on which they have proven very economical. Only one operator is required to run both tractor and scraper.

Massey-Harris Four Wheel Drive Tractor

The four wheel drive tractor produced by Massey-Harris Co., Racine, Wis., has a wide variety of uses. It is especially valuable in snow removal; for hauling ditchers, graders or scrapers; for mowers and for maintenance work. The Adams maintainer, shown in the accompanying illustration, is adapted to highway and street work.



Massey-Harris Four-Wheel Drive Tractor

To Those Who Want The LATEST INFORMATION

any of the following Industrial Literature

WILL BE SENT **FREE** UPON REQUEST

★ *It is a good practice to check this list regularly because descriptions of new bulletins are always being added.*

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company ,Cleveland, Ohio.

Asphalt Rollers

12. How to use Rollers to Save Tamping Costs. 16-page booklet gives details and also specifications of the Erie Roller. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Bituminous Road Paver

25. Specifications and description of new Paver that gathers, proportions, mixes, spreads and compacts bituminous road in one continuous operation offered by Barber-Greene Co., 635 West Park Ave., Aurora, Ill. Ask for Bulletin BPF.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Handling

40. Pouring concrete with portable and permanent belt conveyors on bridges, dams, buildings, locks, sewers, tunnels, etc., is described in a generously illustrated booklet, "CONCRETE HANDLING," by Barber-Greene Co., 635 West Park Ave., Aurora, Ill.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Gallon Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Excavating Buckets

73. Excavating Buckets — shows the various types and sizes, the uses for which they are intended, construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Finishing Machines and Screeds

75. High Speed Screeding and Finishing—the use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages. The Lakewood Engineering Company, Columbus, Ohio.

Graders

76. Latest information about Gallon Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Gallon Iron Works & Mfg. Co., c-o The Jeffrey Mfg. Co., Columbus, Ohio.

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of "Caterpillar" graders.

78. The No. 101 Austin Leaning Wheel Grader is completely detailed and illustrated in Bulletin No. 1238 which shows operation of Z-Bar, back sopper, bank cutter, etc. Published by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

79. Austin No. 77 Dual Drive Motor Graders are completely illustrated and described in Bulletin No. 1239 which also contains construction details, specifications and weights. Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

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6-32

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia.

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

108. Four-wheel-drive trucks increase the range of truck operation and are particularly adapted for economy of operation in road building and maintenance. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Road Construction

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. Caterpillar Tractor Co., Peoria, Ill.

126. A new picture book of the Austin-Western Line of road machinery showing the application of road graders, road rollers, elevating graders, crawler and wheeled wagons, crushing and screening plants, shovels, cranes and excavators, scarifiers and many small tools, is contained in Catalog No. 1247. Copies available on request at The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac. McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

Elevating Graders

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill.

Rollers

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3105 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

145. The Austin Badger, a new, fully convertible ⅜ yard crawler shovel, made by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, is fully described and illustrated in their Bulletin No. 1236.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

164. Booklet on the most popular types of Transits and Levels in general use by Engineers and Surveyors, giving full information on the sizes and styles of these instruments. Issued by C. L. Berger and Sons, Inc., 37 Williams St., Boston 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Tractors, Crawler

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co., Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

175. Caterpillar Tractors. The "Fifty;" the "Thirty-five;" the "Twenty-five." Full data on these models. Caterpillar Tractor Co. Peoria, Ill.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

201. Full data on tar and asphalt kettles, oil burning kettles, pouring pots, torches and hand spraying attachments. Connery & Company, Inc., of Philadelphia.

205. The latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

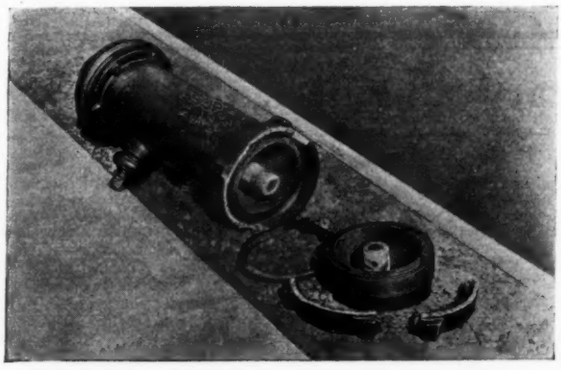
Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Water and Sewerage



Kennedy "Safetop" Hydrant

Unique Fire Hydrant

A development in fire hydrant design, the Kennedy "Safetop" Fire Hydrant, is of special interest to water works superintendents and municipal officials because of the remarkably quick time in which this hydrant can be put back into service after breakage by collision from trucks or automobiles, and the inconsequential cost of repairs. An additional important advantage is that the water pressure need not be shut off while awaiting or making replacements.

The only parts that need be renewed after damage by collision are the inexpensive standpipe breaking ring and stem coupling. The only tools required are a light sledge-hammer, a large screw driver, and a wrench.

No excavation is necessary, nor need the water pressure be shut off to permit repairs. The broken parts can be replaced and the hydrant put back into service in less than half an hour, at a total material and labor cost of less than $10.

Sewage and Storm Water Pump

A new type of pump for handling sewage and storm water or for general drainage or condenser circulating service is announced by Morris Machine Works of Baldwinsville, New York.

Morris New Type Pump

The widely spaced propeller vanes permit passing solids of large size without danger of clogging. A 42-in. pump has shown an efficiency of more than 85 per cent on plant test when delivering 45,000 g.p.m. against a total head of 22½ ft., operating at 600 r.p.m. They are built in sizes 16-inch and larger.

Ideal Vertical Pump Coupling

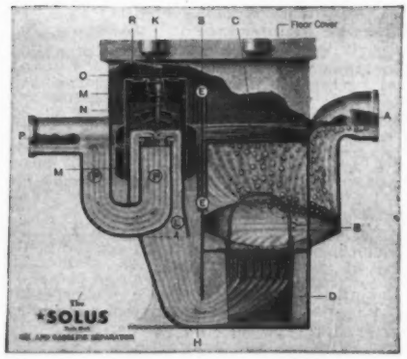
A vertical pump coupling recently has been designed by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. The purpose of the pump coupling is to eliminate the necessity of using a special hollow shaft motor. It removes any possibility of backspin which often results in unscrewing shaft sections. It reduces maintenance costs and permits easy shaft adjustment with standard solid shaft motor drives, an advantage never before available in connection with deepwell turbine pumps.

Since the drive shaft supports the turbine pump rotor and since an adjustment must be available for setting this rotor in the vertical position required to give the proper clearance for the pump rotor, it is necessary to provide a means of raising and lowering the shaft through a small distance. Heretofore this has meant a hollow shaft motor to allow the pump shaft to extend through the motor shaft where, by means of threads on the extended end of the pump shaft and a nut, the required adjustment could be obtained. This adjustment is now provided in the Ideal coupling.

To Prevent Sewer Explosions

The accompanying cross sectional view shows the construction of a new oil and gasoline separator approved by the National Board of Fire Underwriters.

Guarding outlet pipe (P) is brass float (M) which is sensitive to, and actuated by, difference in specific gravity of water and oil. This brass float floats in water and sinks in oil or gasoline. When over-accumulation of oil and gasoline at top two chambers is not removed, brass float (M) sinks and safety valve (float-valve) inside brass float simultaneously and automatically closes outlet pipe to the sewers.



Solus Oil and Gas Separator

It is easy and safe to clean. Instead of climbing down into a filthy, fume-laden pit, the workman simply lifts the floor cover and pumps out the layer accumulation of oil and gasoline. The cleaning process in no way interferes with the continuous operation of the separator.

This separator is made by the makers of Universal Cast Iron Pipe and Fittings—the Central Foundry Company, 420 Lexington avenue, New York City.

New Water Meter by Worthington

The Worthington Pump and Machinery Corporation, Harrison, N. J., has added another model of water meter to its already extensive line. This meter, known as the Model GA, is said to be the most accurate yet developed for extremely low flows as well as for intermediate and high flows. Built in sizes from ⅝ to 2 inches, with normal flow limits from 1 to 160 gallons per minute, these new meters incorporate many unusual features.

Worthington Water Meter

USE THE COUPON ON THE BOTTOM OF PAGE 61

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, tells of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditions. Caterpillar Tractor Co., Peoria, Ill.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Snow Removal

Snow Removal

348. "Winter Maintenance" is the title of a booklet which illustrates many types of snow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., Peoria, Ill.

355. "Conquering Snow With Caterpillars." "An Unwelcome Visitor Is Coming." "A Wall Ten Miles High." Three publications on the snow problem by the Caterpillar Tractor Co., Peoria, Ill.

358. Complete data for selecting the proper size snow plow for your particular make and model of truck. Carl H. Frink, Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Sanitary Engineering

Activation and Aeration

390. A booklet of value to sanitary and chemical engineers describes Norton Porous Mediums of bonded fused alumina (strong chemically stable, uniformly permeable) and their use in aeration of water and sewage. Norton Co., Worcester, Mass.

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Incinerators

396. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 3479 Neville Island, Pittsburgh, Pa. Booklet on request.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. "Data Book"—Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. The McWane Cast Iron Pipe Co., Birmingham, Ala., and Provo, Utah.

407. New "Handbook of deLavaud Centrifugally Cast Iron Pipe" contains useful information for the water works man including revised specifications together with dimensions and weights of deLavaud pipe in accordance with Federal Specifications for Pipe; Water, Cast-Iron (Bell and Spigot) N. WW-P-421. Just issued by the U. S. Pipe and Foundry Co., Burlington, N. J.

Pipe Line Construction

410. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Pumps, Centrifugal

415. Design data for centrifugal pumps for high or low service pumping for waterworks and filtration plants. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps—Sewage

417. Non-clog vertical and horizontal sewage pumps and their characteristics are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

Screens

420. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

427. Bulletin GE31 describes Glass Enclosures for Sludge Beds in detail. Specifications, cross sections, details and illustrations shown are of value to engineers and officials. Sent promptly upon request. American-Moninger Greenhouse Mfg. Corp., Dept. B, 1947 Flushing Ave., Brooklyn, N. Y.

Sludge Treatment

430. Downes Floating Covers and Sludge Digestion Equipment. The Pacific Flush Tank Co., 136 Liberty St., New York, N. Y. Contains photographs of installations of floating covers and technical data on the subject.

Treatment

432. Eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. The Pacific Flush Tank Company of Chicago and New York.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Valves

436. Data Book on Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

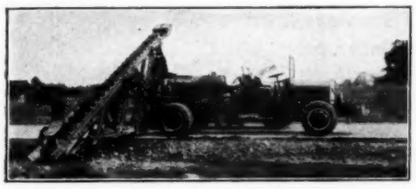
Water Storage

442. "Modern Water Storage" contains 28 pages of reliable information, interesting photographs, authentic engineering data and "Pittsburgh-Des Moines" specifications on various types of elevated tanks, penstocks, pipe lines, stand pipes, steel reservoirs, treating plants and complete water systems.

Highway Equipment

For Finishing Road Shoulders

The Whitcomb-Lehmer road shoulder finishing machine, manufactured by The Whitcomb Locomotive Co., Rochelle, Ill.., and recently placed on the market, has been designed to remove the dirt left on the shoulder and ditch contour by the "blade" and to shape it for final acceptance by the inspectors. The machine consists of elevating buckets operating on a rigid boom, mounted on a heavy-duty truck with an auxiliary transmission specially designed to give the necessary slow speeds, and powered with an 80-horsepower Waukesha six-cylinder engine. The grade is maintained by a hydraulic hoist, controlled by the driver, which automatically raises or lowers the entire boom assembly. The machine will handle a cut of from four to six inches.

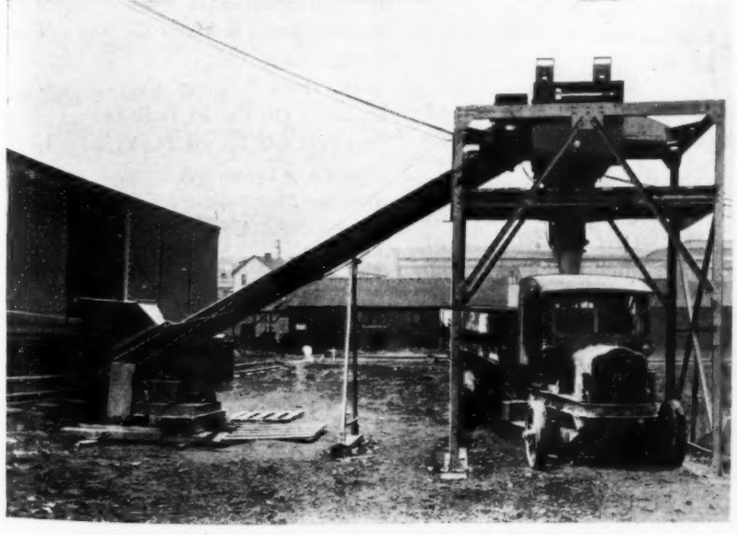


Finishing Road Shoulders

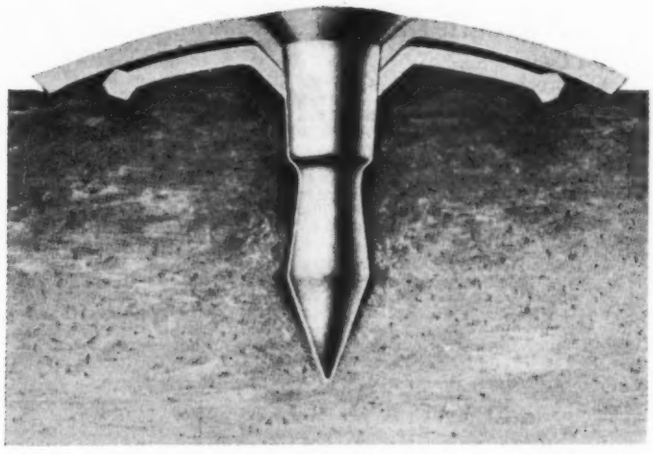
Handy Bulk Cement Plant

A low cost bulk cement plant to allow the economy of bulk cement on a larger variety of jobs has been developed by Blaw-Knox Co., Pittsburgh, Pa. No bin is required. The hinged car hopper is adjustable to car height for the use of either buggies or scoop shovels. A 4-cylinder engine operates the enclosed screw conveyor (no dusting) which loads a 1000-lb. double beam cement weighing batcher. This batcher is equipped with springless dial indicators which show when the batcher is full or empty.

A canvas chute controls the discharge into truck compartments. The entire plant is easily portable.



Blaw-Knox Low Cost Handy Bulk Cement Plant



The Edwards Traffic Lane Markers fasten firmly and are always bright.

Traffic Lane Markers

Permanent, easily seen, low cost street markers aid in enforcing the traffic problem. The markers illustrated here are made of pure zinc or pure brass, which show up well and are non-corrosive and permanent. They lock firmly into the pavement. Ask Edwards Manufacturing Co., Cincinnati, O., for further details in regard to this and other factors.

Saturmix for Low Cost Roads

The problem of applying properly asphalt emulsions to aggregate for low cost road construction has been completely solved, it is claimed, by the development of the Saturmix machine, which provides a means of immersing the aggregate in a bath of asphalt emulsion and withdrawing it in a thoroughly coated condition ready for use. In brief, this process consists of supplying the aggregate to an immersion tank containing asphalt emulsion, in which tank is suspended a perforated basket so arranged as to be removed slowly, permitting drainage of the excess binding material. The perforated basket delivers the coated aggregate to a storage bin, from which point it is available for delivery to trucks reasonably dry, but thoroughly coated.

This process involves a minimum of labor, and it is possible to put material through the Saturmix machine, practically as fast as it can be unloaded, and with the necessity of only one extra man, who is required to operate the machine. The capacity of the plant is 500 tons a day. Because of portability, it is possible to change the set-up as often as may be desirable, thus minimizing hauling distances, and making it profitable to undertake small yardage contracts. This plant is made by the Saturmix Corp., Wooster, O.

Saturmix for Low Cost Roads

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar,'" describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., Peoria, Ill.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125 Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules, General Catalog No. 11.

Transits and Levels

629. A booklet giving full information on the sizes and styles of Berger Transits and Levels will be sent promptly by C. L. Berger & Sons, Inc., 37 Williams St., Boston 19, Mass.

630. Transits and Levels particularly adapted for City, County and State work are described in a 64-page catalog. Warren-Knight Co. 136 No. 12th St. Philadelphia, Pa.

Wire Rope

634. Williamsport Wire Rope Co., Chicago, Ill., has issued a folder illustrating their new method of "preseating."

LATEST PUBLICATIONS

Following are among the latest publications received and have not been described in this section before.

Motor Trucks

105. A new line of heavy duty motor trucks and tractors for dump and commercial hauling is described in literature recently issued by the Sterling Motor Truck Co., Milwaukee, Wis.

106. "Trucks for Public Utilities," is a new illustrated booklet just issued by the International Harvester Co., 606 So. Michigan Ave., Chicago. Covers uses, types, special equipment, bodies and specifications. Sent free on request.

Asphalt Road Construction Manuals

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

Fissurseal

734. A product for solidifying porous strata and blocking off water flows is fully described in recent literature issued by the Sullivan Co., Memphis, Tenn.

Protective Coating

735. "Harvel, The New Protective Coating" is the title of a pamphlet just issued describing this new product for lining all surfaces affected by the severe conditions in sewage disposal plants. Issued by the Harvel Sales Dept., Irvington Varnish and Insulator Co., Irvington, N. J.

Technical Bulletins

736. A new technical booklet, No. 32-3, recording full details of hydrostatic pressure, crushing, tension and other tests of Naylor Spiralweld Cement-Lined Gunite Coated pipe. Now available from the Naylor Pipe Co., 1230 East 92nd St., Chicago, Ill.

737. "Flow Of Water" an engineering bulletin issued by the American Rolling Mill Co., Middletown, Ohio, contains formulae and tables for figuring the carrying capacity of Armco Spiral Welded pipe, loss of head per 1000 ft., diameter of line with given delivery, etc.

Dirt Moving Equipment

738. A complete 44 page booklet describing and illustrating the entire line of Byers Excavating equipment. Many action photos showing uses and details of construction. Issued by the Byers Machine Co., Ravenna, Ohio.

739. Special Bulletin for Dirt Movers showing how lower dirt moving costs can be obtained by the use of the Baker Twin-Cylinder Hydraulic Bulldozer, and the Baker Maney scrapers. These dig, haul, dump, spread and compact up to 700 yards or more per day per single train. Issued by Baker Mfg. Co., Springfield, Ill.

740. "The Use of Explosives," a valuable little book dealing with the use of explosives in construction work during dry periods. Handy pocket size, 16 pages. Will be sent free. Atlas Powder Co., Wilmington, Del.

Turnover Doors

741. The many uses for turnover doors are described and illustrated in a 36 page booklet issued by the J. Edward Ogden Co., Inc., 147 Cedar St., New York. Contains information and specifications of value both to engineer and architect.

Miscellaneous

742. "A Wonder Book of Rubber" portrays the romance of the rubber industry and the part played by the Goodrich Company. Describes the discovery, early uses and manufacturing processes. Issued by the Public Relations Dept., B. F. Goodrich Company, Akron, Ohio.

Index to Advertisements

When you want catalogs describing materials or equipment advertised in PUBLIC WORKS, refer to the classified INDUSTRIAL LITERATURE section beginning on page 61 and order by number.

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